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Railway Mechanical Engineer

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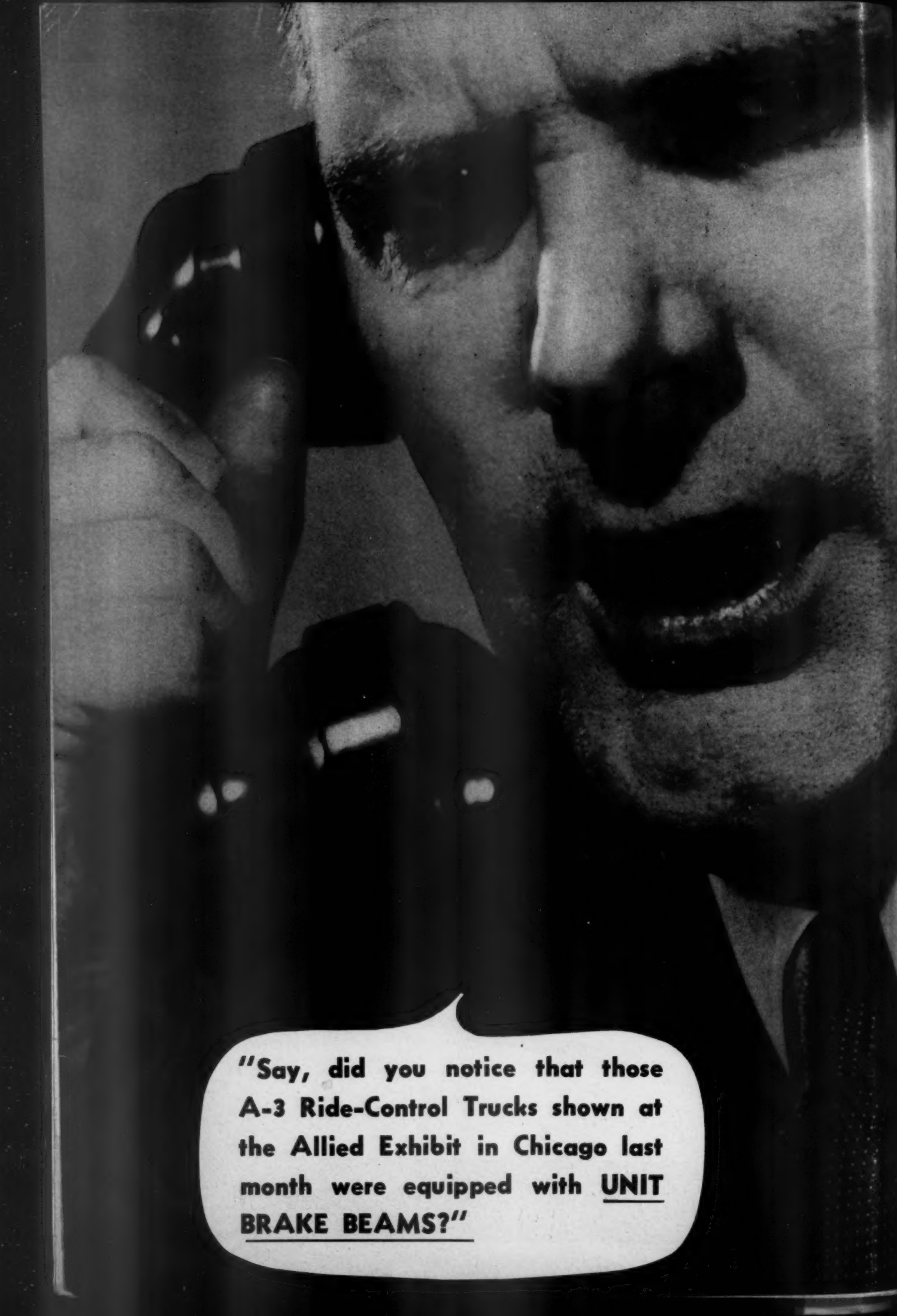
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month were equipped with UNIT
BRAKE BEAMS?"**

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(Names Registered, U. S. Patent Office)

With which is incorporated the RAILWAY ELECTRICAL ENGINEER

Founded in 1832 as the American Rail-Road Journal

OCTOBER, 1946

Volume 120

No. 10

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Roy V. Wright
Editor, New York

Robert E. Thayer
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New York

H. C. Wilcox
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C. L. Combes
Associate Editor, New York

G. J. Weihofen
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Published on the second day of each month by

Simmons-Boardman Publishing Corporation

1309 Noble street, Philadelphia, Pa. Editorial and Executive Offices: 30 Church street, New York 7, and 105 West Adams street, Chicago 3. Branch offices: Terminal Tower, Cleveland 13; 1081 National Press bldg., Washington 4, D. C.; 1038 Henry bldg., Seattle 1, Wash.; 300 Montgomery street, Room 805-806, San Francisco 4, Calif.; 560 W. Sixth street, Los Angeles 14, Calif., 2909 Maple Avenue, Dallas 4, Tex.

Subscriptions, payable in advance and postage free, United States, U. S. possessions and Canada: 1 year, \$3; 2 years, \$5. Foreign countries: 1 year, \$4; 2 years, \$7. Single copies, 35 cents. Address H. E. McCandless, circulation manager, 30 Church street, New York 7.

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The Railway Mechanical Engineer is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.), and is indexed by the Industrial Arts Index and also by the Engineering Index Service. PRINTED IN U. S. A.

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of operations. Perhaps you could use this equipment profitably. Our engineers will be glad to talk it over with you. ¶ The 28" series CINCINNATI Vertical Hydro-Tel Milling Machines are available in three table travels, 60", 96" and 120". Complete details may be obtained by writing for catalog M-1284. Sweet's Catalog File for Mechanical Industries contains a brief description of these machines.

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1946 Mechanical and Electrical Meetings

This issue of the *Railway Mechanical Engineer* brings to you a report on two events of major interest to railroad mechanical and electrical men—one, the meetings of the Co-ordinated Mechanical Associations held at Chicago during the week ending September 7 and the other, the coming meeting of the two A. A. R. Electrical Sections to be held at Chicago, October 22 to 25.

The meetings of the four mechanical associations—The Railway Fuel and Traveling Engineers', The Car Department Officers', The Locomotive Maintenance Officers and the Master Boilermakers'—were the first full meetings to be held since 1941 and the exhibit of the Allied Railway Supply Association was the first exhibit to be held since that year.

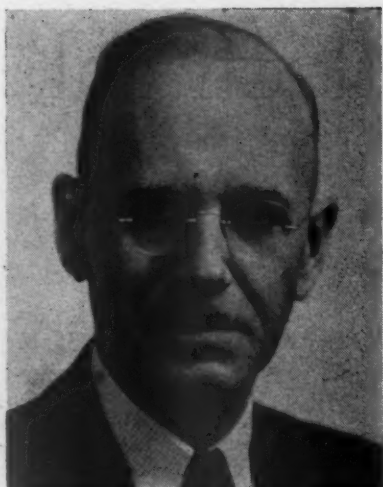
The total attendance—2,343 persons—is an indication not only of the interest in the work of the several groups but is also evidence of the increasing influence of the associations, the members of which are the men who are out in the far corners of the country supervising the operation of the motive power and car equipment of the railroads and the maintenance of that same equipment in shops, engine terminals and car repair and servicing yards. The reports and the discussion in the pages of this issue which deal with the technical aspect of the job of running the mechanical end of the railroads show what a complex job that is getting to be and how necessary it is to bring together the ideas of the many thousands of men who are a part of it. The Chicago meetings accomplished that purpose and it is our privilege to present the report of those meetings for the benefit of those who could not attend.

The meetings of the two A. A. R. Electrical Sections, to be held at the Hotel Sherman, Chicago, October 22-25, marks a resumption of full-scale meetings with

associated exhibits by the Railway Electric Supply Manufacturers Association. Seven years have elapsed since the R. E. S. M. A. held its last exhibit, and it was five years ago in 1941 that the Electrical Section of the Mechanical Division held its last meeting; that was a three-day session. The Electrical Section of the Engineering Division also held a three-day meeting in 1941. Since that time, the various technical committees of the Engineering Division have made reports, but their consideration has been limited to the Committee of Direction and no general meetings of the section have been held.

The electrical groups have shown a persistence of effort which through the depression and the war has been restricted by circumstance. They have come through alive with an enormous amount of work to do. Since the electrical associations started to function in 1908 (then, respectively, the Association of Car Lighting Engineers and the Committee on Electricity, A. R. A.), the amount of electrical equipment on railroads has increased many times and has grown enormously in complexity. Things which have come into being completely since then are electric welding, air conditioning, mercury and fluorescent lighting, streamline trains, Diesel locomotives, train communication, etc. As one man put it, there is scarcely a thing on the railroad now that does not have a wire on it, somewhere. And in recent years, railroads have had to adopt many things without the benefit of recommendations worked out by discussion among themselves. As an example, the caboose power supply question is in almost complete chaos. There are almost as many different ideas of how it should be developed as there are railroads. The forthcoming convention will provide what has become a rare opportunity to find out what is available and to determine the best way to make it serve the railroads.

Two Electrical Sections T



K. H. Gordon



J. M. Trissal



W. S. Lacher

Electrical Section A. A. R. Engineering Division Officers

J. M. Trissal, *chairman*, superintendent of communications and electrical engineer, Illinois Central, Chicago.

K. H. Gordon, *vice-chairman*, assistant electrical engineer, Pennsylvania, Philadelphia, Pa.

W. S. Lacher, *secretary*, Electrical Section, Engineering Division, A. A. R., Chicago

The Electrical Section, Engineering Division, A. A. R., will hold a one-day meeting, Tuesday, Oct. 22, 1946, in the Gray Room, Hotel Sherman, Chicago, 9:30 a. m.

Program

Address of welcome by J. B. Akers, chairman of Engineering Division, (chief engineer, Southern, Washington, D. C.)

Address of the Chairman and Report of Committee of Direction by J. M. Trissal, chairman of the Electrical Section, (superintendent of communications and electrical engineer, Illinois Central, Chicago.)

Reports of the Committees

Committee 1—Power Supply

The report of this committee will be supplemented by a paper by H. F. Brown, engineer electric traction, New York, New Haven & Hartford, on electric power for Diesel-electric locomotive shops.

Committee 2—Electrolysis

G. M. Magee, research engineer of the Engineering Division, will present an outline of an extension of the investigation of the corrosion of steel in concrete which it is proposed to carry out in 1947.

A. E. Archambault, chairman, (assistant engineer, New York Central), will review the work of the Correlative Committee on Cathodic Protection which met in St. Louis on August 19-21, with which the A. A. R. has been identified by four representatives.

Committee 3—Overhead Transmission Line and Catenary Construction

K. H. Gordon, chairman, (assistant electrical engineer of Pennsylvania, Philadelphia, Pa.) will review the work of the A.A.R.-E.E.I. Joint Engineering Committee which was responsible for the development of the Specifications for Electric Supply Lines with the Facilities of Steam Railroads, that were recently adopted by the two parent organizations.

Committee 4—Standardization of Apparatus and Materials

Committee 5—Electric Heating and Welding

Committee 6—Application of Motors

Committee 8—Protective Devices and Safety Rules

Committee 9—Track and Third Rail Bonds

Committee 10—Illumination

The report of this committee will be supplemented by an address by H. H. Helmbright, lamp department, General Electric Company, Cleveland, Ohio.

Committee 11—Design of Indoor and Outdoor Substations

Committee 13—Application of Corrosion-Resisting Materials to Railway Electrical Construction

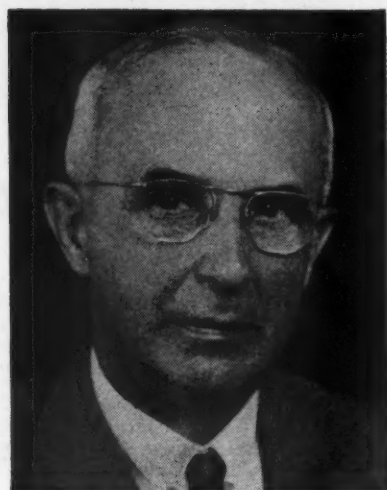
Hold Meetings in Chicago



L. J. Verbar



J. E. Gardner



J. A. Andreucetti

Electrical Section A. A. R. Mechanical Division Officers

L. J. Verbar, *chairman*, air conditioning engineer, Missouri Pacific, St. Louis, Mo.
G. E. Hauss, *first vice-chairman*, electrical supervisor, Baltimore and Ohio, Cincinnati, Ohio.

J. E. Gardner, *second vice-chairman*, electrical engineer, Chicago, Burlington and Quincy, Chicago.

J. A. Andreucetti, *secretary*, chief electrical engineer, Chicago & North Western, Chicago.

The Electrical Section, Mechanical Division, A. A. R., will hold a three-day meeting, Wednesday, Thursday and Friday, Oct. 23, 24 and 25 at the Hotel Sherman, Chicago

The Section will receive and discuss reports of technical committees on the following subjects:

- Car Air Conditioning Equipment
- Car Electrical Equipment
- Automotive and Electric Rolling Stock
- Applications of Radio and Communication Systems to Rolling Stock
- Electric Welding
- Locomotive Electrical Equipment

R.E.S.M.A. To Exhibit in Chicago

For the first time in seven years, the Railway Electric Supply Manufacturers Association will hold an exhibit in conjunction with meetings of two A. A. R. Electrical Sections in the Hotel Sherman, Chicago, October 22-26, 1946



J. S. Hagan

Railway Electric Supply Manufacturers Association

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President: H. A. Morrison, *Railway Mechanical Engineer*, Chicago
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Jr. Vice-President: L. A. Spangler, Westinghouse Electric Corporation, Chicago
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Carlos Dorticos, General Electric Company, Chicago
E. K. Lofton, the Dayton Rubber Mfg. Company, Chicago



A. L. McNeill



H. A. Morrison



L. A. Spangler

Exhibit Directory

Allen-Bradley Co., Milwaukee 4, Wis. Booths Nos. 54 and 55. Represented by: J. J. Mellon, Henry Rosenkranz, John McC. Price, R. C. Thompson, C. T. Roy, E. P. Weller, D. L. Anderson and G. A. Meyers.

Albert & J. M. Anderson Mfg. Co., Boston 10, Mass. Booths Nos. 49 and 50—Power plugs and receptacles, battery charging plugs and receptacles, welding accessories, heavy-duty knife switches, the Multi-tap and BSC multiple outlet devices, and Eithersends. Represented by: Harry G. Durham, P. H. McNay, F. C. Messenger, James B. Luck, Alf E. Anderson, Jr., William B. Pearce and Benjamin Hamilton.

Becker Brothers Carbon Co., Cicero 50, Ill. Booth No. 57—Carbon brushes and contacts.

Benjamin Electric Mfg. Company, Des Plaines, Ill. Booths Nos. 11 and 12—"Steelite" Armor-Clad lighting units, Type RR equipment (two-piece heavy-duty industrial lighting units), pit and tunnel lighting units, viaduct reflectors, elliptical angle reflectors, RLM dome reflectors, "Stock-bin-lites," Type "TX-40" fluorescent units, Type "II-G" fluorescent units, floodlights, "Column-lites," motor driven signals, new commercial fluorescent units and new industrial fluorescent units. Represented by: A. E. Swedenborg, C. F. Stranberg, L. J. Cahill, D. W. Fuller and R. J. Mors.

George R. Berger, Chicago 5, Ill. Booth No. 9—Excel axle generator drive and Grixplex axle pulleys. Represented by George R. Berger.

James G. Biddle Co., Philadelphia 7, Pa. Booth No. 14—Electrical instruments and scientific apparatus. Represented by: Adolph Zell.

W. H. Brady Company, Eau Claire, Wis. Booth No. 32—"Quik-Labels" for coding electric wiring. Represented by: Carl G. Howard.

Bussman Mfg. Co., St. Louis 7, Mo. Booth No. 53—Buss Fuse-trons, Buss Super-Lag fuses, Buss fustats and other Buss fuses. Represented by: L. E. Edwards, A. A. Sommer, E. J. Gasser, C. E. Grover and C. H. Sinn.

Crouse-Hinds Company, Syracuse 1, N. Y. Booth No. 10—Display of a line of condulets and floodlights applicable to the railway field. Represented by R. P. Northrup, W. L. Johnson, P. H. Massman and C. Dubsky.

Cutler-Hammer, Inc., Milwaukee 1, Wis. Booths Nos. 46 and 47—Motor control, electric brakes, limit stops, safety switches, magnetic clutches and accessory apparatus, lifting magnet control, drum control, and a new line of heavy duty push-button stations. Represented by: C. J. Maloney, F. J. Burd, E. L. Singler, Ralph Davis, P. S. Jones, F. A. Wright, E. G. Peterson, L. P. Niessen and K. H. Melzer.

The Dayton Rubber Manufacturing Company, Dayton 1, Ohio. Booths Nos. 20 and 21—One-half scale model of a new light-weight V-belt gear box drive for generators up to 30 kw. using short endless 2-in. V-belts. New removable, link-type connector for 2-in. belts. Represented by: E. K. Lofton, James T. Hamilton, Tim Stickers, L. K. Covelle and E. J. Schmidt.

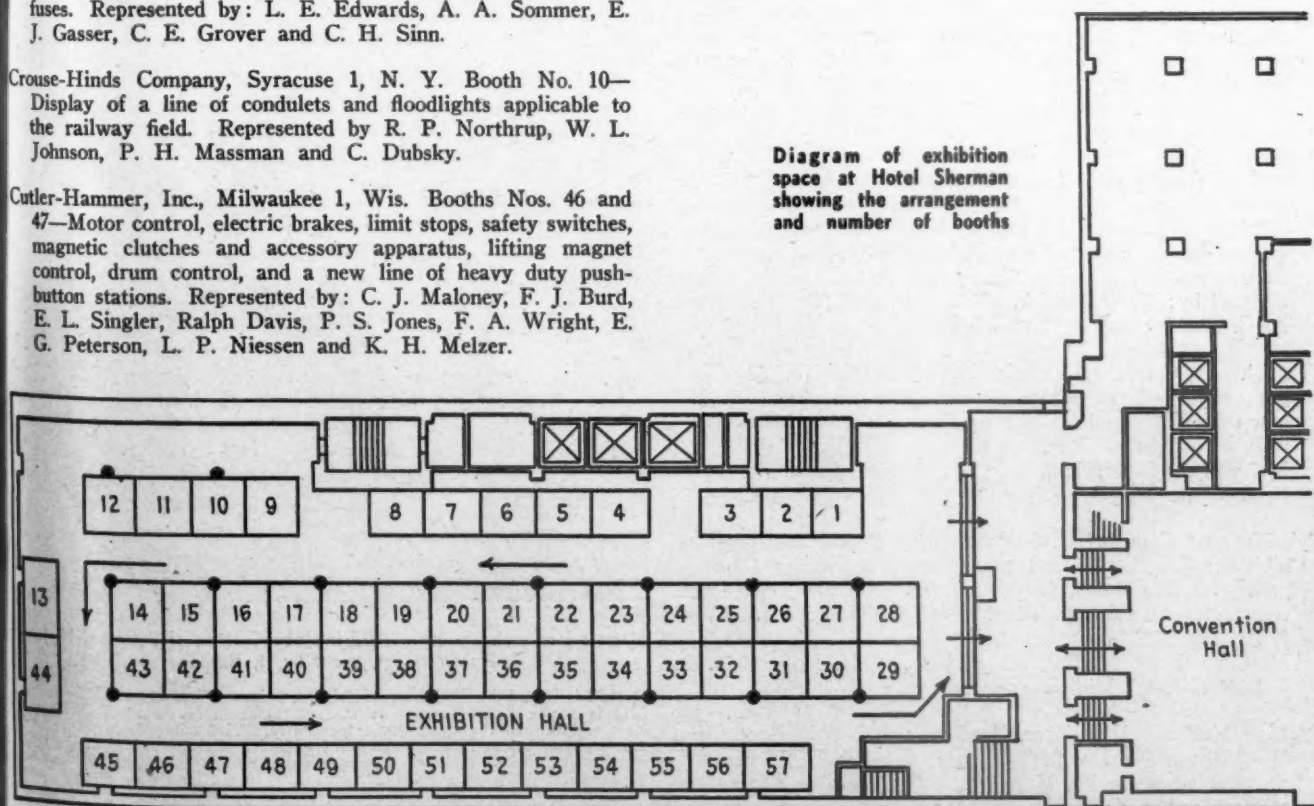
Thomas A. Edison, Incorporated, Storage Battery Division, West Orange, N. J. Booth No. 22—Samples of cell parts and cells of sizes used for assembling batteries for car lighting and air conditioning services as well as for caboose communication power supply. Backdrop showing a photograph of one of the "Daylights" and a typical 25-cell battery assembled in five 5-cell trays. Represented by: G. E. Stringfellow, L. E. Gunther, J. J. Hughes, O. A. Neidermeyer, R. H. Weeks, Jr., G. J. Mertz, C. F. Holcomb, L. R. Oswald and D. G. Ihrig.

The Electric Storage Battery Company, Philadelphia 32, Pa. Booth No. 56—Cut-away batteries showing internal construction, and large pictures showing typical battery applications. Represented by: Geo. H. Bond, H. F. Sauer, C. C. Wilson, R. O. Miles, H. S. C. Folk, W. H. Payne, W. R. Knappenberger, G. V. Cripps, A. O. Ridgely and E. H. Watkins.

General Electric Company, Schenectady 5, N. Y. Booths Nos. 4 and 5—An operating exhibit of a motor-generator for axle drive and an Amplidyne booster inverter for a.c. power supply for passenger cars, water cooler, welding electrodes for inert welding applications, photographs of Amplidyne equipment. Represented by: B. S. Pero, J. R. Alexander, Jack Hause, G. E. Saunders, Paul Lebenbaum, Lynn Covey, C. W. Downs, C. C. Bailey, H. H. Helmbright, F. W. Peters, W. E. Lynch and W. G. Ferguson.

Gould Storage Battery Corporation, Depew, N. Y. Booth 52—Storage batteries for all railway applications including car-lighting and air conditioning batteries, and motive power batteries for electrical industrial trucks. Represented by: H. S. Carlsen, R. C. Cragg, W. W. Halsey, E. C. Kopper and H. A. Matthews.

Diagram of exhibition space at Hotel Sherman showing the arrangement and number of booths



K. W. Battery Co., Chicago, Ill. Booth No. 24—K. W. batteries for train lighting, and air conditioning, and control. Represented by: P. H. Simpson, O. R. Hildebrandt and W. L. Loewenherz.

Loeffelholz Co., Milwaukee 4, Wis. Booth No. 48—Train line connectors, air conditioning outlets and lighting fixtures. Represented by: John S. Taylor and George B. Miller.

Luminator, Inc., Chicago, Ill. Booths Nos. 7 and 8—Full size mock showing new developments in railway car lighting. Represented by: Albert L. Arenberg, Edward C. Zimmerman, Wm. Merlin Adrian, Robert G. Nordquist, Howard A. Cronmiller, Emmett E. Kraybill, Vernon H. Heins, Raymond Lewen, Leslie Brewer, Carl T. Huber, Orval W. Rahn, Lyle N. Snaveley, John Paszkiet, Thomas Ross and Joseph P. Gaynor.

E. A. Lundy Company, Inc., New York 17, N. Y. Booths Nos. 40, 41 and 42—Chrysler Airtemp radial compressor, Aerofuse air conditioning outlets, Nicad nickel cadmium batteries. Represented by: E. A. Lundy, Edgar L. Morris, Harold G. Curry and Bruce I. Elliott.

Mars Signal Light Co., Chicago, Ill. Booth No. 45—An operating exhibit including a type WR 5000 A combination white and red light with dynamotor and automatic air control; type OS 250-RE 14 combination stationary headlight and red figure 8 oscillating lights with automatic air control; type R 250 oscillating red figure 8 steam locomotive light with automatic control. Type RR 250 portable rear train oscillating figure 8 red light with automatic control; type RE 12 portable rear train oscillating figure 8 red light with automatic control; Diesel locomotive flush mounted headlight; type T. L. 25 tender back-up light; type T. L. 26 tender back-up light with red shutter device. Represented by: A. E. Ganzert, A. C. Huhler, C. L. Abrams, W. P. Donaghy, L. C. Bond and J. D. Kennelly.

McKinley-Mockenhaupt Co., Chicago 6, Ill. Booth No. 25—Insulating bushings and multi-angle soldering tools; solderless connectors and lugs (Dossert Mfg. Corp., Brooklyn, N. Y.); rubber sockets, rubber plugs, rubber safety handles and cord sets (Ericson Mfg. Company, Cleveland, Ohio); "Abolite" porcelain enameled steel reflectors and floodlights (The Jones Metal Products Co., West Lafayette, Ohio); renewable fuses and fuse plugs, non-renewable fuses (Pierce Renewable Fuses, Inc., Buffalo, N. Y.); and directive lighting and work light units (Swivelier Company, New York, N. Y.). Represented by: Benjamin P. McKinley, George E. Mason, Paul A. Heise, Lee P. Barsi, Thomas W. Quilter, Donald T. Quilter and Leo G. Mockenhaupt.

Minneapolis-Honeywell Regulator Company, Chicago 11, Ill. Booth No. 34—Electronic air conditioning control equipment for railway passenger cars, Electronic journal alarm system for hot box detection and pneumatic control exhibit for Diesel-electric locomotive engine water temperature control. Represented by: K. W. Schick, M. R. Eastin, V. D. Wissmiller, A. G. Buckley and R. A. Beveridge.

The Okonite Company, Passaic, N. J. Booth No. 38—Okoprene-protected railroad wires and cables; a chart showing how these wires and cables can be applied to various types of railroad problems. Represented by: J. D. Underhill, A. L. McNeill, A. L. McNeill, II, J. J. O'Brien, R. B. Zane and F. J. White.

Pyle-National Company, Chicago 51, Ill. Booth No. —Exhibiting: Locomotive and car fixtures and fittings, turbo-generators, headlights, floodlights, conduit fittings, plugs and receptacles and safety switches. Represented by: W. A. Ross, J. A. Amos, J. V. Baker, C. H. Barton, W. W. Booth, M. M. Connell, W. H. East, C. S. Geis, E. H. Hagensick, G. J. Loewe, T. W. Milligan and J. L. Reese.

Railway Mechanical Engineer, New York 7, N. Y. Booth No. 23—Books and magazines. Represented by: F. J. Fischer, S. W. Hickey, C. W. Merriken, E. L. Woodward, Maurice Peacock and A. G. Oehler.

Railway Purchases and Stores, Chicago 6, Ill. Booth No. 6—Copies of magazine. Represented by: Edward Wray, K. F. Sheeran and J. P. Murphy, Jr.

The Safety Car Heating and Lighting Company, Inc., New York 17, N. Y. Booths Nos. 13 and 14—Exhibit of lighting; motor-alternator control equipment including regulators and relays; large scale pictures of air conditioning equipment and genemotor applications; descriptive literature. Represented by: C. W. T. Stuart, L. Schepmoes, J. Kennedy, J. S. Henry, C. A. Chasey, E. F. Leherissey, C. A. Pinyerd, E. K. Goldschmidt and H. K. Williams, Jr.

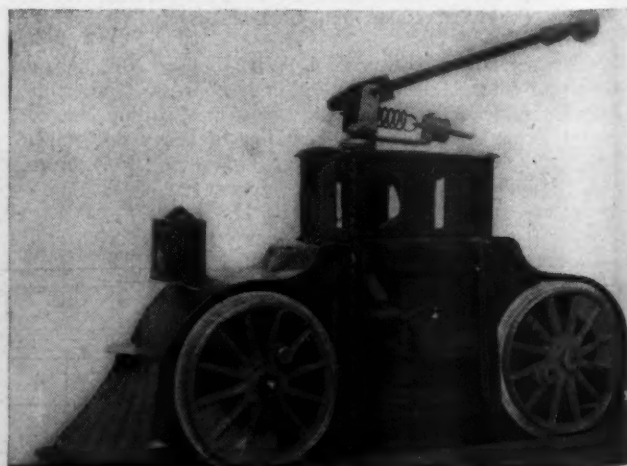
Vapor Car Heating Co., Inc., Chicago, Ill. Booths Nos. 1, 2 and 3—A "4516" steam generator, and an exhibit stand showing the Vapor zone loop system of car heating including a trainline, end valve, joints and couplers, and the "955" Vapor regulator with "1671" electric cut-out valves and fin radiation, to demonstrate latest type of thermostatic control for railway passenger equipment. Represented by: L. H. Gillick, J. G. Clark, F. R. Rutherford, D. J. Jones, Dayton Brundage, A. P. Stickers, William Orr, F. Burns, C. E. Krupp, E. A. Russell, E. H. Burgess, T. J. Lehan and W. M. Smith.

Waukesha Motor Company, Waukesha, Wis. Booths Nos. 17, 18 and 19—Railway-type ice-engine air conditioning unit, railway-type 7½-kw. engine-generator unit, evaporative sub-cooler, sectional-type propane fuel supply cabinet, railway-type 25-kw. Diesel or propane, engine-generator unit. Represented by: L. W. Melcher, N. H. Willis, F. A. Fosdal and C. G. Callow.

Westinghouse Electric Corporation, Chicago 6, Ill. Booths Nos. 15 and 16—Passenger car fans, a.c. water coolers for passenger cars, De-ion circuit breaker panelboards for cars, railroad radio mobile and fixed type transmitters and receivers. Represented by: J. A. Schoch, C. A. Schmidt, E. S. Strout, P. H. Grunnagle, Mr. C. A. Emery, W. G. Brooks, L. A. Spangler, C. B. Bruse, D. D. Loos and D. H. Pollard.

Daniel Woodhead Company, Chicago 6, Ill. Booth No. 43—Protex and Vaprotex portable lamps, bunghole lamps, rubber covered attachment plug caps, rubber covered cord connector, watertite sockets and lamp receptacles, rubber covered sockets, wire strippers and automatic cord winder. Represented by: James A. Edmonds, John G. Hopkinson, Jr., M. J. Korak and Raymon M. Smith.

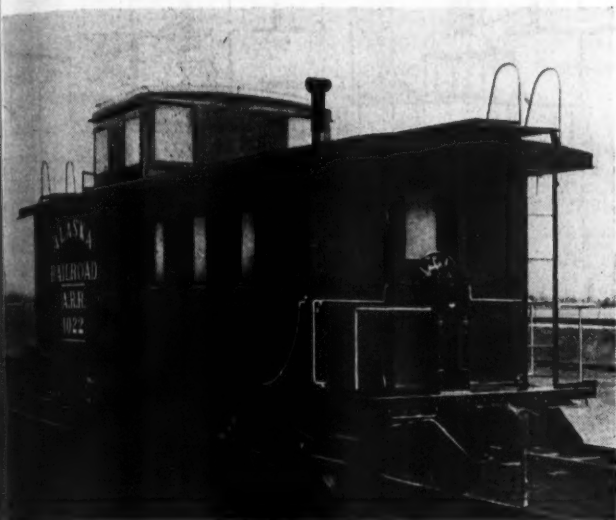
* * *



Electric locomotive built in 1895 by John Garlick, of Paterson, N. J.—Electrical equipment by H. Hathaway

Overall length, 8 in.; diameter of drivers, 2 in.; gauge, 1½ in. The motor field is a permanent horse shoe magnet, mounted longitudinally with the open end toward the rear of the locomotive. The four-pole armature and four-segment commutator are mounted on a longitudinal shaft, on the rear end of which is a single worm-gear meshing with a spur gear mounted on the rear axle. Power supplied through an overhead wire was obtained from a copper-sulphate, gravity type, primary battery. About two hundred of these units were built.

Electrically Lighted Cabooses



The Alaska Railroad's electrically-lighted caboose

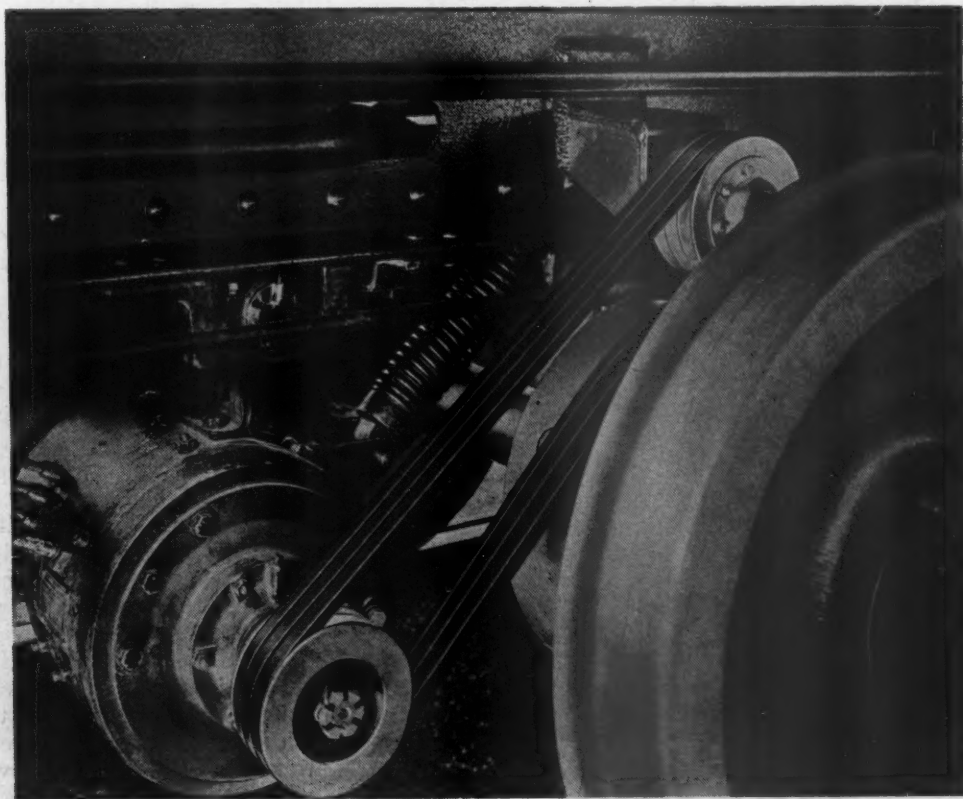
THE International Railway Car and Equipment Manufacturing Company has delivered five steel cabooses to the Alaska Railroad which are designed to meet the rugged operating conditions encountered on this railroad, particularly in the winter time. Underframes are built up of pressed steel shapes and plates. End framing consists of an end plate of continuous lengths from side plate to side plate with I beams to form end door posts and collision posts and with two intermediate end posts located midway between collision posts and door posts. A 3-in. channel belt rail frames the car throughout. Outside sheeting is $\frac{1}{8}$ in. thick, welded to side posts and belt rails and riveted to side sill and side plates. Welded steel plates are used for a permanent watertight roof. The

Five steel cabooses built for the Alaska Railroad have 2-kw. axle-generator power systems for lights and future radio installation

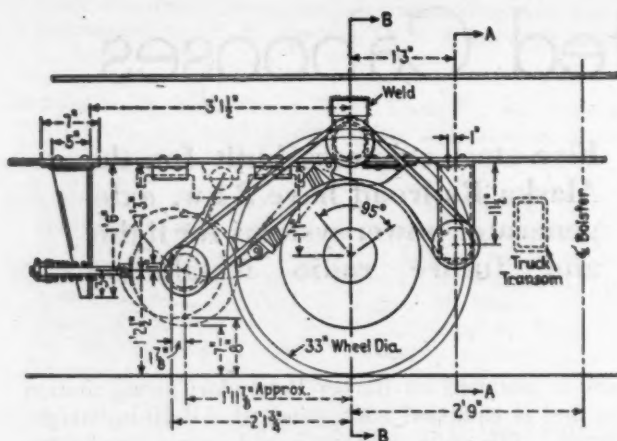
caboose is mounted on Barber-Bettendorf swing motion trucks and is equipped with standard AB-10-in. freight car brake. The ends, side walls and ceiling have three inches of insulation and the floor is composed of $2\frac{3}{8}$ -in. tongue and groove yellow pine dense decking laid crosswise of the car, and topped with a $\frac{1}{2}$ -in. layer of Insulite and a $1\frac{3}{16}$ -in. tongue and groove wearing floor.

Electric power, primarily for lighting, is developed by an axle-generator system. Wiring and outlets have been installed for train communication, but these are for future application. The generator is body hung and is driven by a Dayton "D-R" V-belt drive using three standard endless V-belts. The generator is a Safety Car Heating and Lighting Company machine equipped with a three-groove V-pulley having an outside diameter of 6-in. There are two similar pulleys, also 6-in. in diameter used as idlers and mounted on brackets respectively above the axle-pulley and on the side of the axle-pulley opposite the generator. The axle-pulley is 20-in. in diameter and has a 10-in. face with no crown and no flanges. The V-side of the belts runs over the three V-pulleys and the back or flat side of the belt bears against the axle pulley; is in contact with it for an angle of 95 deg.

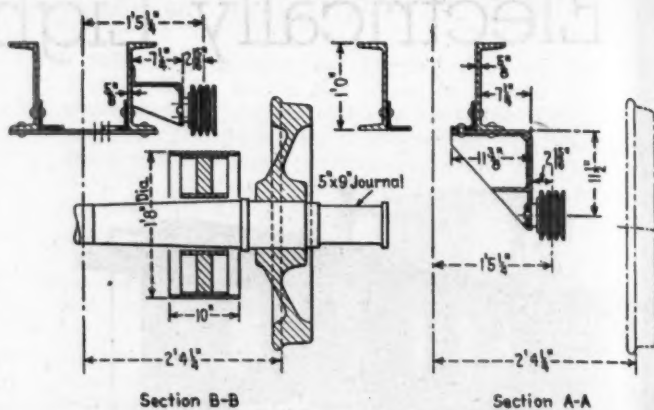
The generator is hung on a suspension from the centersill, and is swung away from the axle at a slight angle, belt tension being supplied by a compression spring bearing between the generator and the centersill. This ar-



One of the generators under the car showing the suspension, belt, tension spring, axle pulley and one of the two idlers



Side elevation of the drive and two sections taken through the car axle and one of the idlers, respectively



Section B-B

Section A-A

range assurance constant belt tension with changes in belt length. A second spring protects the drive against coupling shock. This spring, which is adjustable is supported on a bracket from the centersill on the side of the generator away from the axle. It is in compression and allows the generator to swing only through a small angle.

Generator cut-in speed is about 9 m.p.h. and the full load of 50 amp. at 40 volts is attained at a train speed of 13 m.p.h. The control panel which is located in a Transite-lined cabinet under the cupola on the left side of the car, includes a reverse-current relay, a generator regulator, a lamp regulator, fuses and knife switches.

The battery consists of 25 Edison A4HW cells having a capacity of 150 amp. hr. It is located in an insulated battery box under the caboose floor. All wiring, both underneath and inside is carried in rigid metal conduit. A battery charging receptacle is located at one side close to the battery box.

Lights include two glass-enclosed 50-watt ceiling mounted units in the office end of the caboose, one in the

center or cupola section, two in the bunk end of the caboose and a conductor's desk light. Ceilings and upper side walls are finished in white and the walls below the window sills are gray.

Other features of the caboose include Plexiglas windows, coal stove, coal box, comfortable leather covered mattresses and seats, a closed-top toilet, a wash bowl with a 5-gal. tank and a 4-gal. water cooler.

Radio in Railroad Tunnels

A newly devised system for transmitting train radio signals through long railroad tunnels has been demonstrated by Bendix Radio Division of Bendix Aviation Corporation in collaboration with the Baltimore & Ohio

Railroad tunnels have been considered "dead spots" in train radio communications, but the tests on the Baltimore & Ohio show that trains using VHF space radio can carry on satisfactory continuous end-to-end and train-to-wayside communication while the train is passing through long tunnels. The designers state that simple means have been found to overcome tunnel wall absorption of radio energy and a consequent drop of signal strength over appreciable distances.

The tunnel radio installation was made in a half-mile long tunnel on the Baltimore & Ohio's main east west freight line at Mt. Airy, Md. For the demonstration, Bendix MRT-1B VHF railroad communication units and associated equipment were installed in a baggage car and a caboose of a local freight train. The train was first backed through the 2,760 ft. tunnel, and then made a return trip on the adjacent tracks. Continuous communication was maintained between the forward and rear end of the train, and at no time was there a drop in audio signal. Without the new transmission system, radio signals fall below a commercial level at distances of approximately 300 ft., in tunnel operation.

In the Mt. Airy demonstration, high-gain rhombic antennas were located atop a hill at both entrances to the tunnel. These collector antennas, which "look" down the tracks, are linked with six strands of copper wire running through the tunnel near the crown. Ten inches below, this shielding network, which is three feet wide, is suspended a single insulated wire. The latter carries and re-radiates the radio signal within the tunnel.

Experiments conducted from fixed points outside, revealed that when the transmitter was operated approximately one mile from the tunnel mouth, signal strength within the tunnel compared favorably with free space transmission. The same was true of calls originating within the tunnel to points outside. Readings obtained



Interior of one of the cabooses showing three of the overhead lighting units and the conductor's desk lamp

showed that the transmission line attenuation in the Mt. Airy installation was 15½ db, and that there was a 30 db. drop from line to train. This was offset, however, by the 15 db. gain inherent in the rhombic antennas and by the additional gain secured by locating the collector antennas on the hillside approximately 50 ft. above the roadbed. The system is designed to give a commercial signal with a drop of up to 141 db. between transmitter and receiver in tunnel communication.

The demonstration at Mt. Airy was conducted at an operating frequency of 158.19 megacycles. Throughout the entire time that the train was approaching and passing through the tunnel, a running conversation was maintained between an operator in the baggage car, immediately behind the steam locomotive and tender, and an operator in the caboose at the rear of the train. The position of the train at any particular time had no noticeable effect on signal strength.

The demonstration was witnessed by A. S. Hunt, chief engineer communications and signals, Baltimore & Ohio, and L. J. Prendergast, superintendent of communications, Baltimore & Ohio, under whose supervision the installation at Mt. Airy was made.

Lighting "Trolley" For Enginehouses

The London Midland & Scottish Railway in Great Britain is systematically overhauling its enginehouse lighting and in the process has developed portable lighting units which suggest means for improving American practices. The relighting program employs three separate forms of lighting, namely, lighting from above, from the side, and from pits. As engine sheds fall due for re-roofing or rebuilding, opportunity is taken to install general overhead lighting, making use of 150-watt incandescent lamps in dust-tight cast-iron enamelled reflectors fitted with hinged glazed covers. The lighting unit is large enough to take a 200-watt lamp, if necessary, and

the lamps are connected alternately so that half of them can be switched off.

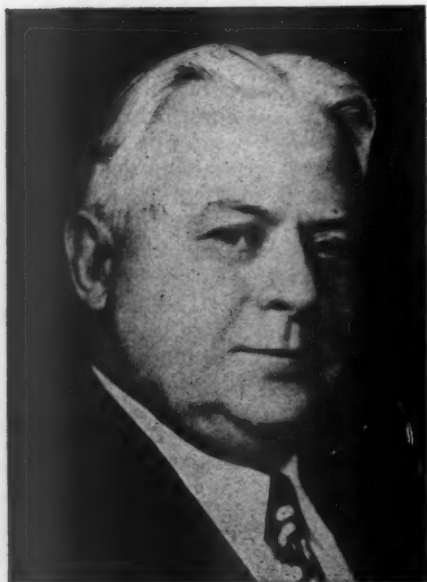
Inspection and repair work on locomotives necessitates good lighting from the side. Neither the old fashioned "duck" lamp nor the electric hand lamp wired for 40 or 50 volts has proved adequate as a means of supplementary lighting and a "wheeled lighting trolley" has been developed to meet this requirement. This mobile unit consists of a welded tubular structure on rubber-tired castors, and on it are mounted two 80-watt fluorescent tubular "daylight" lamps, 5 ft. long, which give almost shadowless lighting. The tubes are mounted horizontally, and the upper one, with its reflector, is on counter-balanced arms which allow it to be set at any level between 5 ft. 6 in. above the floor. In the lowest position it lights the outside motion work of the locomotive while in the uppermost position it can light the inside motion on locomotives which are so equipped. The lower tube and its reflector direct light to the underside of the motion work, thus giving some of the advantages of pit lighting in locations where this is not provided. The fluorescent lamps operate at 200 volts, but the trolley can be fitted with a step-up transformer to take current from 50-volt handlamp receptacles. Of necessity the trolley is made rather narrow, the spaces through which it must pass being limited to that between columns and locomotives in straight sheds. The trolley has a tool tray and a socket for a hand lamp to be used inside fireboxes, etc.

Underneath lighting, such as that required in inspection pits, has been supplied hitherto from filament lamps, but in future the L. M. S. R. will use fluorescent lamps. The tubes, 5 ft. long, with their auxiliary gear, are housed in a cast-iron water-tight unit, which fits into recesses in the pre-cast concrete walls of the pit. The lighting units are not mounted opposite each other, but are staggered to insure greater uniformity of illumination. The lamp housing is glazed with armor-plate glass. As the housing protrudes only ¾ in. into the pit, it causes no obstruction, and it is not likely to be damaged.



The framework is mounted on rubber-tired castors and is fitted with two fluorescent lamps, a receptacle for hand portables and a tray for tools

Joint Meetings of Coordinated Mechanical Associations



Address by W. G. Vollmer and a committee report presented by F. K. Mitchell feature Chicago meetings — J. M. Hall honored



Left to right: J. M. Hall, W. G. Vollmer and F. K. Mitchell

THE members of the four Coordinated Mechanical Associations gathered at the Hotel Sherman, Chicago, on September 4 to 6, inclusive, for their first annual meetings since 1941. Those attending the three-day meetings of the Master Boiler Makers' Association, Locomotive Maintenance Officers' Association, Car Department Officers' Association and the Fuel and Traveling Engineers' Association also had the opportunity of viewing the exhibits of the Allied Railway Supply Association.

Three joint meetings were attended by members and guests of all the associations. At the opening session on Wednesday they assembled to hear an address by W. G. Vollmer, president, Texas & Pacific, who was introduced by L. E. Dix, president, Railway Fuel and Traveling Engineers' Association, and fuel supervisor, Texas & Pacific. This meeting was opened with a welcoming address by the presiding officer, F. P. Roesch, chairman, Committee of the Coordinated Associations.

F. K. Mitchell, general superintendent motive power and rolling stock, New York Central, presented a report on "Training Personnel in the Railroad Industry" before a joint session of the associations on Thursday morning. Mr. Mitchell was chairman of a committee of the Locomotive Maintenance Officers' Association which prepared the report and was introduced to the gathering by the president of that association, J. E. Goodwin, chief mechanical officer, C. & N. W., who presided.

At a joint luncheon meeting held Thursday noon about 1,000 members and guests of the five associations assembled to honor J. M. Hall, director, Bureau of Locomotive Inspection, Interstate Commerce Commission. Introduced by J. E. Goodwin, Mr. Hall addressed the meeting to express his appreciation of the honor accorded to him and to present a brief summary of the accomplishments of the Bureau and the railroads in promoting safety.

In comparing the condition of the steam locomotives of today with those in service in 1911 when the Bureau of Locomotive Inspection was formed, he said, "There is hardly any comparison with the average locomotive today and those of 35 years ago. They are better maintained; the boilers are safer and kept cleaner, and when in need of repairs properly designed patches are applied. Flues and firebox sheets have a much longer life. Hot-water wash-out plants have proven very beneficial; however, I would not neglect to give the water treating companies due credit for much of the improvement in the boiler, flues, etc. I am sure that properly designed treating plants pay for themselves many times over, and the helpful advice given by their service people can hardly be estimated in dollars and cents. That also goes for the helpfulness of the service engineers employed by manufacturers and supply companies, all of whom are going over the railroads and are always ready to help with locomotive problems."

The Future of the Railroads

Since these associations last met, American railroads have performed the greatest transportation feat in history. Pearl Harbor was still ablaze when trains roared out of the East with vital supplies for our exposed and vulnerable West Coast. In that dark hour of our history, the railroads rushed to battle stations. When Uncle Sam demanded land transportation, American railroads delivered. When the final score was in, the railroads had handled 97 per cent of the organized troop movements, and 90 per cent of all military traffic. Our industry proved beyond a shadow of a doubt that railroads are the nation's primary transportation agency. Other public carriers are but auxiliary to the railroads.

Yet these same railroads, bulwark of the nation's transport system, find themselves hedged about by government-subsidized competition and restrictive regulations of all kinds. As they face a future of leveling freight and passenger volume, as the nation's business adjusts itself to peacetime standards, the railroads must plan carefully and pursue vigorously an alert, progressive policy if they are to meet post-war competition successfully. During the war, sound, business-like methods of operation frequently were abandoned under the impact of military necessity. Getting the job done was the prime consideration. Those days are over now, and railroads must return to those principles of operation which were made secondary during the war.

Railroads today employ approximately 1,400,000 men and women to whom they have paid approximately five billion dollars annually in wages. In 1945 the American railroads made purchases amounting to \$1,600,000,000 from nearly 15,000 different concerns who, in turn, gave employment to several million men and women and paid correspondingly huge sums in wages. In preparation for still greater service to the American public, the railroads will spend this year an estimated one billion dollars for new coaches, with improved heating, lighting and ventilating qualities. New and vastly improved sleeping cars are being built; in fact, whole new trains are under construction—new trains that will embody the latest in comfort, luxury, safety and speed.

Only the Railroads Pay Their Way

Of the four principal systems of transportation, the railroad is the only one that owns and maintains its fixed plant and pays taxes upon it. By fixed plant, we mean the roadway, rails and fastenings, signal systems and all the other structures and equipment necessary to provide safe and efficient freight and passenger transportation service. Other transportation systems have been spared the expense of building and maintaining their fixed plants. The taxpayers have provided them with magnificent highways, elaborate and expensive air terminals and services, and costly inland waterways. All that the other agencies of transport need for the operation of their businesses are the vehicles and equipment and the facilities to maintain and keep them in operation.

More than 300 terminal-type airports have been constructed in the United States by various city, state and federal governments. These airports are almost wholly operated and maintained at public expense. In Texas, there is a large and extensively used airfield which cost the taxpayers nearly \$3,500,000. If the ordinary principles of business applied to the operation of this airfield—interest payment on the capital investment, amortization, and out-of-pocket costs of maintenance and operation—the annual expense would approximate \$250,000. Three commercial airlines use this field and for the privilege of this use they pay \$14,000, while the municipal government which owns and operates it for the taxpayers receives approximately the same amount of revenue from the pay toilets, pay telephones, and various concessions such as, restaurant and newsstand. Based on the number of flights daily—landing and take-off considered as one operation—the unit cost per flight amounts to about \$8.23. Of this sum the airline pays 53c; the taxpayers \$7.70.

Plans are now being made to build in New York City an airport to cost about \$200,000,000. This figure represents more than the total investment of all the nineteen certified commercial airlines. Neither the City of New York, nor the state or federal governments will derive any taxes from this costly facility; it

Nation's primary transportation agency must fight for fair and equal treatment—Job of every railroad man to help in telling public of the facts of the case

By W. G. Vollmer

President, Texas & Pacific

will be a tax consumer, not a tax producer, for the maintenance cost will be borne by the taxpayers. Now, let us compare this with the two large railroad stations in New York City, the Grand Central and the Pennsylvania Stations. These two stations cost \$200,000,000 and were paid for and are maintained by the railroads out of earnings. And in addition, these two railroads pay state and local taxes of \$5,000,000 annually.

According to the Report of Investigation and Research on Public Aids to Domestic Transportation, it is revealed that "Total federal annual expenditures for navigation increased from \$37,652,000 in 1922 to well over \$100,000,000 in each year from 1934 to 1940." It is customary to think that rivers are natural ways of transportation, but it is by no means true. In order to be serviceable to boat and barge operations, they literally have to be rebuilt.

Federal Aid Repaid by Railroads

A great many people have the mistaken idea that railroads were heavily subsidized by the federal government during the early stages of their development. The federal government did make grants of land to a number of railroads as an aid and encouragement to those railroads to extend their lines through vast stretches of unpopulated and unproductive lands. Although federal aid was received for only 17,000 miles of railroad, all of the 235,000 miles of railroad in the United States were subject to an equalization agreement whereby all railroads transport government freight, military personnel and government civilian personnel on a half-rate and half-fare basis. Approximately a total of two billion dollars will finally have been refunded by the railroads to the federal government for lands aggregating 174 million dollars in original value. No other system of transportation has, at any time, handled government freight at reduced rates or fares.

The railroads are certainly not opposed to good highways and streets, nor are they opposed to the taxpayers, if they elect to do so, furnishing the airlines with air terminals and service facilities, and the inland water carriers with improved and federal-maintained waterways. What the railroads do oppose, and feel justified in criticizing, is the policy of underwriting, through taxes, the legitimate expenses of commercial transportation agencies engaged in business for a profit.

The railroads are looking to the future, to the changes which advancing technology is bringing, and to the better service which continued investment in plant and equipment will make possible. They should be assured of such governmental policies as will encourage rather than hinder the development of the better transportation service which they can and should render.

Railroads are so vital to the safety of our country in time of war, and to the welfare of the nation in time of peace, that they must continue to operate, either under private enterprise and initiative, or under government control. The latter alternative is certainly not in keeping with the economic philosophy of the majority of the people in the United States. America was founded and has grown to greatness under the free, competitive enterprise system. Subsidies that give one system of transportation competitive advantages over another are contrary to the American system. All the railroads ask is that the principles of free, competitive enterprise apply to all. Let the service each renders the nation be the measure by which it justifies its existence.

Every Railroad Man Must Help

You, as members of your respective associations, are the accepted leaders in your respective fields of endeavor. You are more than that, however. You are railroad men representing the welfare of your respective railroads at all times. Furthermore, you are responsible citizens of the communities and the nation in which you live. I have learned that it is the duty of every railroad employee, no matter what is his rank or position, to make it crystal clear to American citizenry that the railroad industry is being unfairly treated by the people's governments—local, state and federal—by the continued subsidization of other

forms of transportation, and the continued failure to assess adequate user charges against all commercial users of transportation facilities built and furnished at the sole expense of taxpayers.

We must drive this home to all our people so that they will know that the railroad business is an essential part of all our people's lives and welfare and deserves fair and equal treatment with all of our competitors. We must tell them and show them and keep reminding them over and over again of this most unfair inequality which besets our industry today and which, to my mind, is one of our biggest problems, if not the biggest.

Training Railroad Men for Bigger Jobs*

The heaviest obligation which rests upon the shoulders of any railroad officer is that of creating and training an efficient, well-informed, smooth-functioning organization. Surely the locomotive maintenance officer should consider this obligation no less lightly than any railroad executive. He should realize that only by so doing can he guarantee to his superiors and to the management of his railroad the continued successful operation of his department. Further than this, he should realize that only by so doing can he successfully conduct his own assignment and minimize his difficulty in so doing.

The secret behind the creation of the proper type of organization is found in the proper selection and training of its personnel. The training of personnel should be wide enough in scope to cover all crafts and classes of employees from the time of their employment until their retirement. Such a training program naturally divides itself into two parts, the prepromotional training and the post-promotional training of the individuals. This principle has been recognized over a long period, but unfortunately, the recognition has not brought forth any too sound a system of carrying it into effect.

Prior to World War II, prepromotional training was confined all to universally to apprentice training systems, some of which were more-or-less haphazard and entirely inadequate, and others in varying degrees more effective and complete. The shortage of manpower and the necessity to hurriedly train previously unqualified men for important work during the war brought on several other training procedures, notably so-called "JIT" or Job Instruction Training and "JRI" or Job Relation

**Good organizations are built
by selecting good men and making
sure they are well trained**

Instruction. In the main we believe these were only stop-gap measures, by-products of the war situation, but that they did show necessity for some parallel type of training to be conducted continuously.

The effectiveness of this prepromotional training in the past was not too good, this being due, first, to the fact that not enough attention was paid to the selection of apprentices; secondly, to the fact that the types of men were not available for selection, and finally, to the fact that railroad management was slow in awakening to the realization that something more than a precursory attempt to select and train men was an absolute necessity. Far too often the task was taken lightly, was unthorough, unstudied and consequently ineffective. There was too generally a misconception of the goal which such training should accomplish, and too little thought given to taking the material which was available, even though it were inferior, and making it adequate for some definite gainful purpose. During the last few years, there was altogether too much tendency on the part of many to throw up their hands and blame their failure on the manpower shortage than to get down to the basic factors involved in the problem and work it out in a logical, thorough manner.

Generally speaking, the railroads of the country are suffering at this time from these errors. There is still a manpower shortage and there is still a tendency to take the attitude that, because of the manpower shortage, nothing much can be done about the situation until plenty of men are available. On the contrary, we believe that now is the time to plan a more effective system of selection and training for the future and to get it into

* Abstract of a report of the Locomotive Maintenance Officers' Association Committee on Personnel Relations presented at a joint session of the Coordinated Mechanical Associations at the Hotel Sherman, Chicago, September 5. The committee is composed of F. K. Mitchell (chairman), general superintendent motive power and rolling stock, New York Central System; C. F. Brooks, mechanical engineer, Erie; C. H. McAmis, schedule supervisor, Missouri Pacific; K. Berg, superintendent motive power, Pittsburgh & Lake Erie; W. H. Hinerman, assistant to superintendent motive power, Chesapeake & Ohio; H. J. Schulthess, chief of personnel, Denver & Rio Grande Western; G. A. Howard, supervisor apprentice training, Canadian National, and Roy V. Wright, editor, *Railway Mechanical Engineer*.

* * *



Car equipment built by Pullman-Standard for one of the seven-car "Pere Marquettes"

operation in order to take advantage of the manpower as it becomes available.

The remarks which we have made about the inadequacy of selection and prepromotional training of personnel are no less pertinent in connection with the post-promotional training which has been carried on in the past. Far too often men were promoted for reasons fundamentally unsound, and far too often, even though the appointments were sound, the appointees were placed on supervisory jobs with no more instruction than "there it is, go to it." If by reason of the individual's characteristics and background he was successfully able to carry out the assignment, it was not due to any planned assistance which he received after his promotion. If the appointee was not successful, seldom did it happen that anyone in authority was sufficiently interested in why, to point out to him his errors and attempt to make him satisfactory through proper instruction. Unfortunately, the usual procedure was to pursue the easiest course, that is, take the appointee off the job, set him back to his previous status, and appoint someone else. Such a procedure naturally had only ill effects in discouraging men from accepting promotion, and in many instances management lost the advantage of the experience which the individual had already gained, and which, if directed in the proper channels and properly supervised, might have become beneficial. These malpractices were quite often the outgrowth of an over supply of personnel.

During the war years when the demand for supervision was greater than the supply, and when unfortunately the burden on any supervisor was far greater than normally, we began to awaken to the necessity to make the most of such material for supervisors as were available. Even at that our efforts to instruct and train supervisors in general were pitiful.

This committee has looked into the methods pursued and the results obtained on numerous Class I Railroads. Information on this subject was obtained from the personnel officers of these roads through a questionnaire. The cooperation and prompt response from those personnel officers are very much appreciated, and has been quite enlightening. We found, unfortunately, that although some roads seem to be doing a grand job, far too many have been content to try in a more-or-less superficial way certain instructional programs prompted by state, federal and other outside interests, but that far too few have done anything really constructive, and many at the moment are doing little or nothing. The lack of a planned system seems to be prevalent. The very lack of such a system is responsible for the dilemma in which many railroads now find themselves. Generally, however, they are beginning to awaken to the realization that something must be done about the situation, and in this respect we find encouragement. We feel, as was expressed in connection with the remarks on prepromotional training, that now is the time to establish a uniform well planned program so that the situation very soon will be materially improved.

The committee would like to suggest for consideration and action a few pertinent ideas which it believes should be incorporated in any such program.

Our suggestions are enumerated below and will later be discussed:

- 1—A sound policy on the employment of apprentices.
- 2—A definite and thorough program of education for regular, helper or special apprentices.
- 3—A definite incentive program for trainees.
- 4—An adequate system of keeping in touch with the development and the capabilities of each trainee.
- 5—A definite sound policy on the selection of men for promotion to supervisory positions.
- 6—A well planned method of training and the instruction of selectees for promotion.
- 7—A test and recheck of promotional selectees.
- 8—A policy on initial permanent supervisory assignments.
- 9—A definite promotional incentive plan.
- 10—An adequate, on-the-job supervisory, training program.
- 11—An adequate program for study and recording the capabilities of supervisors for advancement to executive positions.
- 12—A policy covering the selection and training of men for executive positions.

Employment Policy

The time is past when inferior material should be considered for employment as apprentices. The policy of waiting for applicants to come to the railroad for employment should be dis-

carded. The practice of employing apprentices only because of friendship, relationship or other such reasons tends to lower the standard of the personnel. The time has come when the railroads should go out to the high schools and trade schools and select the men which they desire to bring into their employment. Except in unusual circumstances regular apprentices with less than high-school education should not be employed. Even these should be carefully picked. The cooperation of educational institutions can be had, and should be sought. No young man who is not eminently suited or fully convinced that he wishes to make railroading his life's work should be employed. In selecting these new apprentices, unless the employer is convinced the candidate is of such timber that his capabilities will enable him to advance far beyond the stage of journeyman, he should not be accepted.

Through careful analysis of employment needs, only sufficient apprentices should be employed adequately to protect retirement, mortality, promotion and losses due to normal resignations. It should be very definitely known that at the time of graduation there will be a position for him in order to avoid discouragement which has existed in the past through necessity to lay off apprentices shortly after they had completed their apprentice courses.

The employment policy should include a frank discussion with the candidate which would clarify for him definitely what he may expect in the way of training, wages, promotions and responsibilities, which means that he should be inspired with the idea that the apprenticeship is not merely a stepping stone to journeyman mechanic's rate, but opening the door to a railroad career in which the highest positions are the only limitations.

The employment policy should, of course, include such definite features as age limitation, physical qualifications and moral standing.

The same procedure, and most of the same factors, should be incorporated in the employment policy covering special apprentices, the chief variation being the education requirement, which should be not less than bachelor of science degree in mechanical, or in some specified branch of engineering. It is realized, however, that a variation from this requirement may be advisable in that certain college students, who have definitely made up their minds prior to graduation that they wished to follow railroad work, might be given an opportunity to start their special apprenticeship before completion of their schooling, and that others who already had railroad experience as regular apprentices and then had gone through college should be credited in their special apprentice training with the time served as regular apprentice.

In order to increase the effectiveness of the above mentioned employment policy, we would strongly urge that the opportunities afforded young men through employment with the railroad be properly and extensively publicized through paid advertising in local newspapers and high-school and college publications. The necessity for such an advertising campaign is emphasized by the all too prevalent tendency on the part of our nation's universities to discourage their graduates from accepting employment with the railroad companies.

Program for Education

It is strongly urged that every Class I railroad afford to their apprentices a training program consisting of both on-the-job and school-room training. The present trend seems to be toward giving labor organizations a greater hand and more responsibility in this training program. Typical of this trend are the agreements now in effect on the New York Central, the Union Pacific and the Chicago & North Western. The first two mentioned provide for training to be done on the railroad under the supervision of an apprentice committee composed of members of both management and labor. The latter provides for apprentice training to be carried on by an outside agency and in cooperation with management.

(Attached to the report, as exhibits, were copies of the apprentice training agreements of the New York Central and the Union Pacific as typical examples of the type of agreement where the training is carried on under the supervision of a committee composed of members of both management and labor; the agreement of the Chicago & North Western as typical of the agreement where the training is carried on by an outside agency in co-operation with the management. Also attached were the special apprentice agreements of the New York Central and

the Pennsylvania and samples of several forms and reports used by the New York Central, Pennsylvania and the Reading in rating and recording the work of personnel under training.—EDITOR.)

Trainees' Incentive Program

It is definitely felt that, if the training program for our apprentices is to be effective, there must be definite incentives set up, and that these should be used to inspire the apprentices, whether they be regular, helper or special, to greater activity, more thorough study, and ambition for advancement. It has already been pointed out that, in the hiring of apprentices, the incentive idea should be instilled, in that they should be fully informed of what the possibilities of advancement are. There are a number of other incentives which may prove very effective. Inspection trips to other shops and even to outside industry offered to those who show the most proficiency and interest in their work. Opportunities to participate in special test work is a further incentive which may be found effective. Opportunities to apprentices to act as assistant instructors when they show unusual proficiency can also be used to good advantage. It is believed, however, that one of the greatest incentives which can be offered, both from the point of benefit to the apprentice and to the railroad, would be the creation of certain annual scholarships to be awarded to the apprentice in a given territory who throughout his regular apprentice course shall have shown the greatest proficiency. It is suggested that these scholarships should be at selected engineering universities and should incorporate a provision that those awarded such scholarships shall, on the one hand, obligate themselves to continue their employment with the railroad company after completion of their college courses, and, on the other hand, the railroad company employ them upon graduation. It is felt that there are and always will be, among regular apprentices and perhaps even among the helper apprentices, highly qualified men who, only by reason of financial embarrassment, have not had the opportunity of a college education and if given an opportunity of a college education at the expense of the railroad company will develop into excellent supervisors and executives. It is pointed out that such a procedure would not only raise the standard of the railroad company's personnel, but would at once tend to erase any feeling which may now, or in the future, exist against the college graduate.

For many reasons a thorough and complete record of the apprentice's training development and capabilities should be kept. This is true even though no incentive plans are in existence, and even more true and essential where such plans are followed. On the one hand, it is highly advantageous to the railroad company to know exactly what progress and what possibilities each of the trainees are making and have. If there are to be incentives and awards they must be made on an entirely fair and impartial basis, and only by the use of such records can this be done. We shall make no attempt to recommend any particular system.

Selecting Men for Promotion

The tendency which has existed in the past to make haphazard selections of men for promotion to supervisory positions is so preeminently erroneous, and unfortunately so widely followed, that plans to correct the situation should be instituted at once. The time to begin the selection of these men is during their apprenticeship. Records will be of great value if properly used, but the record should not cease when the apprentice course is finished. Every well-organized department of any size should have at least three candidates for every supervisory position. The candidates for the minor positions should be among those who have graduated from the apprentice courses. It is felt that it should be made known to those men that they are considered candidates for certain positions and that their desires should be consulted as to what possible openings may meet their approval. It is well that they know they are candidates and that their actions and development are being watched, and that they know when selections are made why other individuals are given first preference and what they need to do to rate first preference.

It is not considered sufficient merely to select the men who are candidates for supervisory positions, but it is highly advisable, after their selection, that they be trained in the job for which selected. Possibly these candidates should have class-room training which should include instructions, lectures on the responsibilities carried by various supervisors, how their work should be conducted, what their assignments are, how these assignments

can best be carried out and how the work coming under such supervisors must be done. They should, perhaps, be made familiar with such pertinent features as the federal law covering rules and regulations for inspecting and testing various types of locomotives and tenders; the company's mechanical regulations and special instructions covering the work which is assigned to various supervisors; the safety rules and general safety policies; the labor agreements involved; handling of men; cooperation between the supervisor and his superiors and with other departments.

It may be well to bring to these schools problems for solution which have to do with the every-day occurrences in connection with the above. For example, theoretical labor problems, such as grievances, discipline, etc. All of these things and many more are felt to be essential training features.

Each candidate for a supervisory position should have an opportunity to handle minor supervisory positions on a temporary basis in cases of illness, vacation, etc. Let first one and then another have the opportunity. Find out by so doing whether there has been an error in the selection of a candidate and at the same time develop supervisory confidence in the selectee.

Right here it might be pertinent to suggest that after each such tour of duty, the selectee be given an opportunity to discuss his experience and the problems which he ran up against before the school of selectees in the presence of a competent advisor so that all may benefit thereby, and be properly advised as to how such problems should be met. This process may eliminate entirely some selectees previously considered as good material, and at the same time it would have a tendency to eliminate the possibility of a young man being assigned to a permanent position and then having to be demoted.

Initial Assignments

If all of the training and careful observance of candidates for supervisory positions have been carried out, when the new supervisor goes on a permanent assignment for the first time he will find it far less difficult to acclimate himself to the conditions of his new position. Such assignment should incorporate, first, an understanding with the candidate that the position to which he is being assigned is one of such a nature that he is confident he can handle, and further, one which meets with his approval. It is fundamental that no man can be satisfied or successful on any assignment in which he is not whole-heartedly interested and does not enjoy. To assign a man to any other type of position is unfair to him and to management. The policy should likewise incorporate the sponsorship of some older supervisor whose duty should be to advise and counsel the new supervisor to the end that any problems which he faces that are not thoroughly understood by him may be clarified. It is suggested that when the new supervisor errs, he should not be criticized on the first error, but the error should be called to the attention of the sponsor, if such sponsor is not aware of it, and by him to the attention of the new supervisor in the nature of fatherly advice. If, after so doing, the new supervisor is still prone to commit the same type of error and is found entirely unsatisfactory in the position to which he has been promoted, it should not be the policy immediately to demote him, but an attempt should be made to find a supervisory niche in which he can function properly. It is felt that it is much better to make a good supervisor out of a mediocre one with some shortcomings than to attempt to fit an entirely new candidate into the supervisory ranks. On the other hand, if it is definitely determined that the appointment was made in error, he should be told quite definitely what his shortcomings are, if and when it becomes necessary to demote him.

Promotional Incentive Plan

Every supervisor should know whither he is bound, what the road of advancement is to be, the salaries of the supervisory positions he may aspire to and the responsibilities. He should be encouraged to conduct and train himself so that when the opportunity comes he can accept the proffered advancement with confidence and with a reasonable certainty that he will be successful. To inspire him to this end, he should be made a part of the department or shop management in that he should know what the policies of the management are, why things are done as they are done, and that as a part of the management his ideas and recommendations for the improving of the quality and character of the work or operation of his department will be considered carefully and given an opportunity for trial, if found feasible. He should never be discouraged in offering constructive criticism or sug-

gestions. If there are departmental meetings at which he is not normally required to attend, he should have opportunity to attend them occasionally in order to understand the problems of his superiors and his management. The rates of pay of any supervisory position should be commensurate with the duties and responsibilities required of him and should be sufficiently above the men over which he has supervision to make it worth his while.

On-the-Job Training Program

It is believed that no development of a supervisory personnel improvement program can be carried out without an adequate system of instruction. Such systems as conference methods have been explored. Job instruction and other similar programs are being used with varying degrees of success. It is our thought in connection with these programs that certain fundamental features should be observed. First, they should be made interesting and should apply in a homely method to every day problems of the supervisor. As little theory as possible should be injected therein, and as much practical material as possible should be used. They should not be of a burdensome nature, but it should be recognized that the supervisor has many routine duties which require a large part of his time while on the job, with many obligations which require much of his time when off the job. With that recognition these training courses should be designed to give him the greatest benefit in the minimum time. There are a number of outside agencies, private, federal and state, which can be taken advantage of in carrying out these courses. The effectiveness of their work is believed to be tied up closely with the problem of making their respective methods apply intimately with railroad problems. If there is any tendency toward attempting to instruct railroad supervisors by instructors not thoroughly familiar with railroad problems, it should be discouraged. Perhaps the most effective supervisor training which can be devised will be found to be home-made and centered on local well-recognized problems and conducted by well-known and respected company employees.

Capabilities for Executive Positions

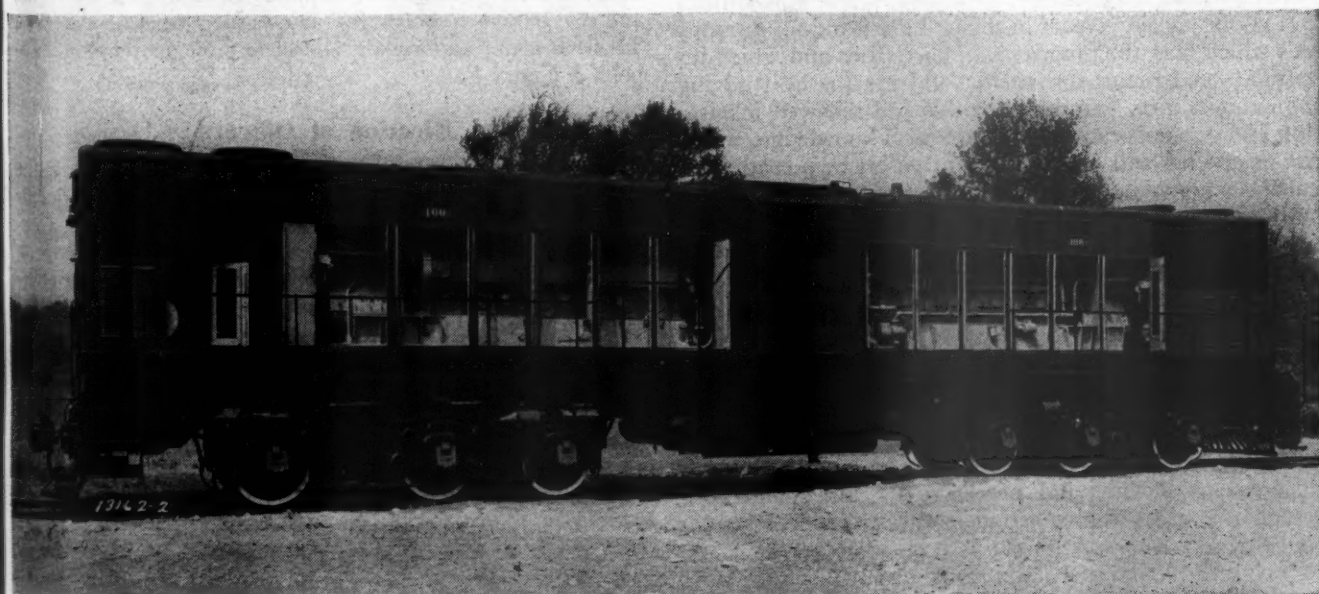
The study and recording of a supervisor's capabilities for advancement to executive positions is one of the most important problems yet discussed, and is likewise probably one which has been the most neglected. At this stage, the field has been narrowed. The number of likely candidates is few. Peculiar characteristics fundamentally required for such candidates are not found in all supervisors no matter how successful they may have been in relatively minor positions. In the selection of men for such positions as master mechanics, shop superintendents, superintendents of motive power even greater care must be exercised than in any of the selections heretofore discussed. These men will

not only be required to conduct extensive departmental operations, but become contact men with other departments and even with the public. These requirements necessitate broader vision, more thorough training, greater capabilities, and finer personalities than the average. They must be men who have been trained to be conscious of costs, somewhat familiar with accounting methods, railroad operation in general, and with public relations.

Therefore, in order to be doubly sure that selections for these positions are properly made, an intimate knowledge of the possible candidates must be had. In order to obtain this intimate knowledge, the men in key or executive positions should have even better records of possible candidates than is the case when less important positions are to be filled. A knowledge of the candidate's private and public life is essential, a knowledge of how he reacts under pressure and adverse circumstances, and how he accepts responsibilities. A knowledge of whether or not he is capable of making quick correct decisions must be had; in fact, in making these selections almost everything must be known about a man before it can be established that he can be a satisfactory candidate. Some well rounded out, thorough method of obtaining this information on the possible candidates is highly desirable.

In view of the fact, as previously mentioned, that careful study of the candidate must be made to insure against any failure to select the proper man, it is highly desirable in any organization that there be sufficient assistant executives so that the selectees may be assigned to these positions, given responsibilities as they are able to assume them and trained thoroughly before they are advanced to the executive position. It is not so much a matter of whether the duties and burdens evolving upon the executive require an assistant or assistants that should determine whether these positions are existent, but rather the necessity to use them as a proving ground for the man or men who must eventually step into the executive position. It is not essential that all such candidates be from either the ranks of those with college education or from the ranks of those who have not had college education. Many men in either category have proved far superior to those in the other category when the opportunity to exercise executive authority is given them. Although the satisfactory candidates for such positions should have a good mechanical background, thorough fundamental training and experience, these are not the most highly essential of the qualifications; rather they are the qualifications of the general group from which executives should be selected, but from among these the candidates with the best personalities normally will prove to be the most successful. The training of these candidates, after they have been assigned to assist executives, should be general. The committee is of the opinion that the system such as is being tried out on the Denver & Rio Grande Western may assist in the training of candidates for executive positions.

* * *



Baldwin-Westinghouse transfer locomotive, with two 1,000-hp. Diesel-electric power plants, for the Elgin, Joliet & Eastern

Locomotive Officers Meet

THE Locomotive Maintenance Officers' Association devoted its entire three-day session at the Hotel Sherman, Chicago, to a consideration of the varied problems of the maintenance of steam and Diesel-electric locomotives and the question of the selection and training of personnel. There were registered, at the meetings on September 4, 5 and 6, about 250 of the total membership of more than 600 which the association has built up during a period devoid of annual meetings.

Following a joint session of the Co-ordinated Associations, the first technical session was called to order by President J. E. Goodwin, chief mechanical officer, Chicago & North Western.

At the first session an address was delivered by Roy V. Wright, editor, *Railway Mechanical Engineer*, who said, in part:

Roy V. Wright on Association Responsibility

"What are the responsibilities of the Locomotive Maintenance Officers' Association?" In the field of locomotive maintenance, repair and construction, there is a wide and important range of activities not specifically covered by the A.A.R. Mechanical Division and other railway mechanical organizations, such as the Railway Fuel and Traveling Engineers' Association and the Master Boiler Makers' Association. These include problems of shop and enginehouse organization and management, as well as the task of selecting, training and handling personnel—supervisors, as well as workers in the ranks. Here is a field of almost unlimited possibilities! Then there is the broad field, including methods and facilities involved in the repair, maintenance and construction of locomotives in shops and enginehouses. And this task will never be ended, because of the continual improvements that are being made in the design and operation of locomotives and new tools and equipment which are being introduced to facilitate these operations.

"This comprehends your responsibilities. How can you discharge them?"

"The individual member, by attending the conventions and taking an active part in them; by serving on committees which plan the programs and activities and which investigate and report on specific subjects; or by studying the exhibits, may carry back to his job renewed inspiration and greater practical and technical knowledge, which can be applied with distinct benefit on his own road. This enhances his value and may lead to promotion to greater authority and responsibility.

"If we, as an association are to justify fully our existence in the interests of improved railroad operation, we must work harder and harder. Since we have no paid or full-time executive to administer details and help carry on, the officers and members of the executive committee must assume heavy responsibilities. This involves such important items as the critical selection of committee personnel and the necessary coaching and guidance to assist the committees in their studies and in drawing up their reports. The vital necessity for intelligent, constructive and aggressive action in this direction is sometimes overlooked.

"After the committee assignments are made and reports compiled, the job is only well started. To rivet it over and make it complete—assuming that meanwhile the last

Annual meeting at Chicago considers reports on the training of personnel, steam and Diesel maintenance and safety promotion

year's proceedings have been published—careful plans and action must be taken to build up the membership and coordinate their efforts with those of the related mechanical associations. Finally, but not by any means the least important, is the setting up of machinery so that the reports will be effectively placed before the convention and full and free discussions assured. This is no simple task. It cannot be done offhand and without careful preliminary study and preparation. A poor presentation of the report to the convention, or conditions which handicap intelligent discussion, or a poor presiding officer, can offset much of the good work done in preparing the report in the first place. Such things as carelessness in calling the meetings to order on time, or allowing them to drag, must be jealously guarded against."

During the meeting eight committee reports were presented. The subjects and the chairmen of the respective committees are as follows: Personnel Training in the Railroad Industry, F. K. Mitchell, general superintendent of motive power and rolling stock, New York Central; Spring Rigging Maintenance, W. H. Ohnesorge, shop superintendent, Boston & Maine; Reclamation of Locomotive Parts by Welding, G. E. Bennett, master mechanic, Chicago & Eastern Illinois; Developments in Shop Tools, E. A. Greame, tool foreman, Delaware, Lackawanna & Western; Air Brake Maintenance, J. W. Hawthorne, superintendent motive power, Central of Georgia; Safety in Shop and Enginehouse, W. H. Roberts, superintendent of safety, Chicago & North Western; Lubrication of Steam Locomotive, J. R. Brooks, superintendent lubrication and supplies, Chesapeake & Ohio, and Classified Repairs for Diesel-electric Locomotives, T. T. Bickle, supervisor Diesel engines, Atchison, Topeka & Santa Fe.

Election of Officers

The following officers were elected to serve for the coming year: president, S. O. Rentschler, superintendent motive power, Elgin, Joliet & Eastern; first vice-president, C. D. Allen, master mechanic, Chesapeake & Ohio; J. W. Hawthorne, second vice-president, superintendent motive power, Central of Georgia; third vice-president, G. W. Bennett, master mechanic, Chicago & Eastern Illinois; secretary-treasurer, C. M. Lipscomb, assistant to production engineer, Missouri Pacific.

The executive committee for the coming year will be composed of C. D. Allen, (chairman); C. E. Bell, master mechanic, Illinois Central; G. A. Silva, superintendent locomotive maintenance, Boston & Maine; F. R. Hosack, assistant chief mechanical officer, Missouri Pacific; J. P. Morris, general assistant (mechanical), Atchison, Topeka & Santa Fe; A. Malmgren, assistant superintendent, St. Louis-San Francisco, and W. H. Sagstetter, chief mechanical officer, Denver & Rio Grande Western.

Locomotive Maintenance Officers' Association

Officers 1945-46

President: *J. E. Goodwin, chief mechanical officer, Chicago & North Western and Chicago, St. Paul, Minneapolis & Omaha.*

Second Vice-President: *S. O. Rentschler, superintendent motive power, Elgin, Joliet & Eastern, Joliet, Ill.*

Third Vice-President: *C. D. Allen, master mechanic, Chesapeake & Ohio, Huntington, W. Va.*

Secretary-Treasurer: *C. M. Lipscomb, assistant to production engineer, Missouri Pacific, North Little Rock, Ark.*

Advisory Committee

D. S. Ellis, vice-president, Lima Locomotive Works, Lima, Ohio.

C. B. Hitch, chief mechanical officer, Chesapeake & Ohio, Richmond, Va.

O. A. Garber, chief mechanical officer, Missouri Pacific, St. Louis, Mo.

B. M. Brown, general superintendent motive power, Southern Pacific, San Francisco, Calif.

D. J. Sheehan, superintendent motive power, Chicago & Eastern Illinois, Danville, Ill.



J. E. Goodwin



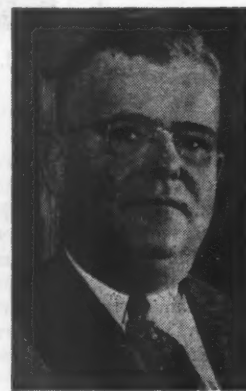
S. O. Rentschler



C. D. Allen



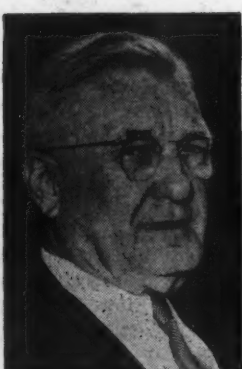
C. M. Lipscomb



D. S. Ellis



C. B. Hitch



O. A. Garber



B. M. Brown



D. J. Sheehan

The Association's advisory board will be composed of O. A. Garber, chief mechanical officer, Missouri Pacific Lines, F. K. Mitchell, general superintendent motive power and rolling stock, New York Central; C. B. Hitch,

chief mechanical officer, Chesapeake & Ohio; J. E. Goodwin, chief mechanical officer, Chicago & North Western, and D. J. Sheehan, superintendent motive power, Chicago & Eastern Illinois.

Report on Locomotive Brake Equipment

In 1934 the 8-ET locomotive brake equipment was introduced. In order to accomplish the desired smoothness of control and harmonious functioning with existing car equipment, refinements and modifications were introduced that resulted in a brake-valve pedestal to which is attached the feed valve, reducing valve, combined emergency-relay vent valve and signal-line fixture, equalizing discharge-valve portion, automatic brake valve and independent brake valve.

While the 8-ET locomotive brake equipment is new, its newness does not in general present many radical changes in



J. W. Hawthorne,
Chairman

maintenance procedures. As in the past, maintenance is still of two general types, preventive and corrective, both of which are only as efficient as the selection and training of the supervisory, inspection and repair forces permit.

Since our experience during the war, an adequate training program, covering a planned period of time, that is capable of repetition at the expiration of completed courses is more necessary than ever. Such planned training must provide for the orderly replacement of required personnel due to advancement, retirement or untimely death of existing forces.

The 8-ET locomotive brake equipment and its present-day modified and refined descendant, as compared to the old equipment, is sufficiently complex as to require supervisory help that has had shop experience. Candidates for such supervisory positions should, therefore, be selected from shop forces, and other qualities being equal, have a high-school or better educational background. The training should include fundamentals in air-brake design, air-brake structures, functions, their applications to railroad work, and, where possible, a visit of reasonable duration to the air-brake manufacturer's plant to obtain first-hand knowledge of the problems of manufacture and the care with which the essential items of daily use are prepared for railroad application.

The supervisory candidate is then ready for the final phase of his training, the actual experience of working with existing supervisory personnel. This last phase should acquaint the candidate with the daily problems to be met, methods of inspection and repair, as well as the means available to instruct, train and examine the inspection and repair forces. Experience should also be obtained in the instruction and examination of operating forces for an orderly and consistent method of operation.

The rate at which such personnel is trained should be timed to the ability of each individual railroad to absorb the candidates with a reasonable assurance of advancement to positions of more responsibility.

Training program for maintenance of 8-ET brake equipment outlined — Central repair points favored

Supervisory personnel of this caliber would then be a profitable investment, since they are competent and capable of extending their knowledge and experience to the training and qualification of men assigned as inspectors and repairmen.

The training of inspectors and repairmen for air-brake work may be accomplished in several ways. A tried and proved method is by example and explanation, introduced to the new inspector or repairman, the requirements of his job, and, with a minimum of reading and study on his part, prepare him for a questions and answers examination. The question-and-answer examination should be designed to fix in his mind, and enable him to display to the examiner, a working knowledge of the requirements of the duties to which he has been assigned.

With the basic tools at hand, an intelligently trained supervisory staff and a thoughtfully prepared inspection and maintenance force, some routine of procedure for proper inspection and repair should be set up,—first, to minimize the time required for inspection, and second, to provide a constant check and continuous availability of air-brake equipment suitable for service.

All too frequently, delay or failure or both are due to mechanical failure caused by a loose pipe clamp, improperly operating valve, or other improperly inspected piece of equipment. All such incidents can be minimized by proper inspection and the accompanying repair.

Inspection should begin as soon after the arrival of the locomotive from a trip as the physical and man-hour conditions will permit.

Daily inspection by qualified inspectors should first determine if the locomotive is due for a periodic inspection. If not, such items as indicated herewith should be inspected and tested, viz., air-compressor governor, brake-pipe and signal hose at pilot, brake cylinders, piping and connections, and piston travel; the main reservoir should be drained; all remaining piping should be inspected for leaks and tightness; air gauges should be checked; feed valves, distributing valves, vent valves, and all other air-operated devices should be known to be in proper operating condition.

Periodic inspection should include the same detail as the daily inspection with the addition of the following: orifice test of compressor or compressors, comparison of air gauges against master gauge, and replacement of parts determined to be beyond their service life (such service life should usually be based upon the previous experience of each individual railroad).

Any defects discovered during inspection should be immediately corrected and defective parts replaced by ones known to be in good condition.

An adequate pool stock of parts and fittings, along with close cooperation with the stores department to assure prompt turnover of repaired items, is essential.

Equally important is a planned schedule of appropriate tests that are an integral part of the inspection procedure and, in their essence, comprise the backbone of the preventive portion of any maintenance program. Parts removed as a result of the foregoing inspection and test should be immediately turned over to the stores department for forwarding to the nearest repair point, where proper cleaning, repair and tests are to be performed.

The introduction of the 8-ET locomotive brake equipment complicated repairs. Additional parts, such as the equalizing

piston portion, brake-valve pedestal, separate independent brake valve, its bracket, and automatic brake-valve portion are not only more awkward to handle due to their weight or form, but also require additional test racks and adapter plates that represent a considerable capital outlay; and the capital outlay is at least of sufficient amount to preclude the establishment of a number of conveniently located repair points, such as at major roundhouses.

Consequently, it becomes almost mandatory to establish a minimum number of major repair points to proceed economically with the proper corrective maintenance.

Primarily the physical condition of the repair room is important. It must be large enough to accommodate present requirements and permit future expansion. It must be light, airy, warm and clean. Space should be available for storage of repairable, dirty equipment, preferably by separate parts. Adequate cleaning tanks with proper venting facilities and adequate drainage should be available. Work benches arranged with adequate holding devices, room for tools, and storage drawers for small parts, are most helpful, and should be adjacent to test racks upon which the particular device being repaired is to be tested.

Most of the pieces of the 8-ET locomotive brake equipment permit the use of a holding device designed especially for that piece, and so designed that the piece being worked upon can be firmly held and yet moved at will into a comfortable position and at the proper height for easy and good workmanship on bushings, slide valves or seats, as well as for the removal and inspection of small parts.

Small tools, such as speed wrenches, sockets, and ratchet

wrenches, have done much to improve output and reduce injuries.

Approved test racks, with necessary adapter plates, when regularly checked and kept in good repair, have justified the expenditure for their purchase in a more reliable and longer lasting valvular mechanism.

The form of some of the small parts incorporated in the 8-ET locomotive brake equipment has resulted in very ingenious jigs and fixtures to facilitate their removal and repair.

The major problem with the 8-A distributing valve has been the reconditioning of the large slide valve and its seat. Here, in the writer's experience, three different methods have been tried with varying degrees of success. We are still trying, and it is most interesting to note that after the first lamentations (due to necessary change in long established practice) the qualified workman and the intelligently trained supervisor soon become engrossed in exerting their combined ingenuity in solving each problem as it arises.

This teamwork, then, is the ultimate goal, and results from an intelligently planned training for supervision and workmen, so that when coupled with adequate facilities, even new equipment such as the 8-ET locomotive brake equipment or any of its subsequent offspring, do not for long present any serious maintenance problem.

The report was signed by J. W. Hawthorne, superintendent motive power, Central of Georgia (chairman); A. M. Malmgren, assistant superintendent, St. Louis-San Francisco; D. R. Collins, superintendent air brakes, Denver & Rio Grande Western; S. M. Ward air brake supervisor, Missouri Pacific; A. J. Pichetto, general air brake engineer, Illinois Central and W. E. Vergan, supervisor air brakes, Missouri-Kansas-Texas.

Reclaiming Locomotive Parts by Welding

Although there are several processes of arc welding, the ones in which the railroads are interested are the methods of using plain wire electrode and the coated rod for shielded welding. In shielded welding the molten steel is protected from the atmosphere. Without this protection the metal would take into combination various forms of oxides and nitrides. These impurities tend to weaken and embrittle the weldment, as well as lessen its resistance to corrosive action.

In welding with the unshielded arc, the molten globules which pass from the electrode to the work are exposed to the ambient

Economies in salvaging locomotive parts on one road with 157 machines amounted to \$360,000 in one year

claims to have saved \$360,000. in one year through reclaiming parts formerly scrapped.

Most shops large enough to afford a welding foreman or instructor find that through the ingenuity of these men, as well as the welders themselves, they are able to equip the shop with positioners, preheating and normalizing furnaces, and various gadgets which help perform the work. It is that down-hand welding is more satisfactory in producing a quality weld, and this can many times be accomplished through the use of a home-made positioner, or one of the many on the market today. In making the work easier for the welder, through the use of a positioner, there is no argument but that production will increase and the quality improve.

In the preparation of materials for welding, the old saying, "Cleanliness is next to Godliness" should be foremost in everyone's mind, as a good weld absolutely cannot be made on dirty metal. There are various methods of cleaning materials, such as sandblasting, shot blasting, burning, and the use of various chemical solutions. In the case of gas welding, a good flux is necessary to perform a good weld.

Preheating should be given consideration in all welding. The various materials will no doubt vary in temperature for preheats, and this can be determined either through use of heat indicator pills or sticks, which change color at varying temperatures, or through the use of a surface pyrometer or thermo-couple. In gas welding, quite often the spreading of the heat from the torch will take care of the preheating without provision of other means. In large weldments, such as, cast-iron locomotive cylinders it is advantageous to use an oven.

The treatment of a weld after its completion is important, especially with the larger weldments. There are many methods used for normalizing or stress-relieving. Where parts are small and movable, and in such quantity as to make it possible, the car-body furnace with automatic temperature-control is ideal.



George E. Bennett,
Chairman

atmosphere, which contains chiefly oxygen and nitrogen. If the metal, during the fusion process, is completely protected from contact with the atmosphere, injurious chemical combinations cannot take place. In atomic hydrogen welding, this is achieved by use of hydrogen gas. However, this method requires special equipment and would not be practical in the railroad shop.

The economies effected in the salvaging of locomotive parts, formerly scrapped, amount to a good many million dollars per year on the railroads of this country. One of our large mid-western railroads, which has on its property 157 welding machines,

These furnaces can be purchased but many shops find it possible to build their own. Larger parts, such as main cylinders, can be covered with sheet metal and stress relieved by burning charcoal. Most railroads use a formula for mild steels and highly refined wrought iron of 1,350 to 1,400 deg. F., for a period of one hour per inch of thickness. Generally speaking, this will take care of most materials used on locomotives. However, with alloy steels, by all means get in touch with the manufacturer for recommendations for preheating and stress-relieving.

Reclamation of Locomotive Parts

Stokers—Most stokers have one thing in common, and that is the helical screw which moves the coal. The wear on the screw is considerable. On a test on one screw which originally cost \$103.84 it was found that with the use of \$6.40 for material plus \$26.40 for labor, it could be reclaimed and made it as good as new, if not better, at a total cost of \$32.80, or a net saving of \$71.04, exclusive of shop overhead. In the building up of a worn screw, a layer of mild steel was applied following this up with another layer of wear-resisting metal. This screw was in service 160,000 miles, and showed much less wear than a new screw which ran the same number of miles. The reason for the use of the mild steel first was on account of the difference in cost between it and wear-resisting metal, and the screw to which this was to be applied was so badly worn that the two layers of metal were necessary to bring it up to standard.

The conveyor trough naturally comes in for a great deal of wear and although most troughs are made of manganese steel, saving can be made by renewing the worn section of the trough by replacing it with regular boiler steel.

In the Standard stokers, considerable wear will be found on the rear half of the distributor plate. This can be built up very easily through welding. Universal joint blocks, which are subject to wear in the pin holes can be salvaged by plugging the holes by welding.

A great deal of wear occurs in the rear bowl of the Standard stoker conveyors. This is really a universal joint in the conveyor trough, and can be easily reclaimed through arc welding.

On stokers equipped with crushers a great deal of wear on the fingers of the crusher, and these can be built up by the use of arc welding.

Drive shafts, which are square and work in a sleeve, often become worn to the point where a great deal of lost motion is found. The shaft itself can be built up through welding and remachined to standard size, making it necessary only to renew the sleeve.

There are many Duplex stokers in service today, which offer possibilities for the reclamation of various parts, such as rack housing teeth worn, threaded end of pistons which have become loose in the rack fit, reverse valve stems which have become worn in the pawl catch area, elevator and main drive pawls, and pawl shifters and shifter plates.

Inspirators—Inspirators and injectors, sooner or later become worn around the threads, not only at pipe connections, but also the threads in the cap holes. These can easily be repaired by use of gas welding, either by building up the worn sections or by welding a new section to the body of the injector itself.

Operating valve stems, where the button end has fractured, can easily be built up and remachined.

Main Frames—Formerly main frames were welded by the use of the gas torch and bronze. This has not proved entirely satisfactory and most frame welding is done now by the arc process. If the frame is broken in a section where it is possible, it has proved advantageous to give the frame from $\frac{1}{16}$ in. to $\frac{3}{16}$ in. expansion. When this is impossible and the weld is made without expansion the weld will be successful if it is made slowly and with as low heat as possible.

Many roads are now strengthening cross-brace connections and brackets to main frames by welding. The grain structure of the main frame must be considered before this is undertaken, as it has proved that when welding across the grain structure the frame will fracture at that point sooner or later. It is also advisable to use two welders while welding a main frame, one on each side, but caution must be taken in the proper amount of heat used.

The practice of cutting out a section of frame and replacing with a new section is used to remove a number of old welds. This is satisfactory in the case of the old vanadium steel frame, in which there has been considerable breakage.

Main cylinders—It is the practice on some roads to sandblast the cylinder, so the extent of the fracture can be seen. The fracture is then veed out, with the width at the top of the vee equal to the depth of the metal to be welded. The bottom of the vee is kept to a minimum width. The cylinder is then placed in an oven and preheated, either by the use of gas or charcoal, for a period of six to eight hours. The temperature should be brought up gradually to between 500 and 600 deg. F. The heat should be maintained as near 500 deg. as possible during the welding process. It will be found that in maintaining a heat such as this it will be impossible for any one welder to work longer than 10 to 15 minutes, and it is usually the practice to have three or four welders on the job so that the individual will not become tired from the heat or the nervous tension of welding too long at one time.

The type of oven usually used in one that has many doors hinged to the side, through which the welder can work, and, by the use of some sheet asbestos, can protect himself against the heat of the casting and that created through the welding. The type of brass usually used in Osweld M-25, or its equivalent. After the weld has been completed, the temperature should be maintained at 500 to 550 deg. F. for a period of four to eight hours, and then gradually reduced to the temperature at which the cylinder can be handled. This should take it at least 24 to 36 hours.

Many railroads have welded the back cylinder head to the cylinder, thus doing away with any chance of leakage through loose or broken studs. It is, of course, a simple matter to weld a cast steel head to a cast steel cylinder by the use of the arc weld process. In doing this, the old cylinder head can be used by plugging the stud holes first, chamfering off the inside of the head so that a vee will be formed between the head and the cylinder, and the head then welded to the cylinder. Several methods of holding the head tightly to the cylinder are used, either through use of four of the original studs, which are welded around and into the weldment, or by use of one large stud which is run from the front of the cylinder through the piston opening of the back head.

To weld a cast steel cylinder head to a cast iron cylinder involves more problems. The cylinder has to be so constructed that if it is done while the cylinder is on the locomotive a welder can reach the side nearest the frame. This is not always possible, as some cylinders are designed so there is no space between the head and the frame.

The question of preheating must also be considered and some roads have been successful in building a charcoal fire in the cylinder barrel several hours before the welding is done. It is also necessary to keep this fire burning several hours after the weldment has been made.

Piston Heads—The greatest amount of wear on a gun-iron piston head takes place on the lower third of the circumference. Many roads, if the ring groove is not worn, build up this worn portion of the head with a good grade of bearing bronze. This is not a difficult job, and the only caution necessary is to be sure that the area to receive the bronze is absolutely clean and free from oil. This is best accomplished by sandblasting or shot blasting. Where the bronze is to start and end, a small groove should be chipped into the head to provide a good ending of the bronze so that it will not feather out. Little preheating is necessary, as the gas method is used. This same method is also quite popular in building up piston valve T-rings as it makes possible quite a saving, not only in material, but in labor, when the valve bushings are enlarged by boring.

Spring rigging—Spring rigging offers a chance for savings by using arc welding instead of the old method of forge welding of spring saddles which have become worn, either in the section where the roller wears, or where one of the legs has fouled the frame.

There has been a difference of opinion as to whether welding should be applied to strap hangers, but if the hanger is properly normalized or stress-relieved after welding there is no reason why the process should not be successful.

Pin holes which are badly worn can be either plugged and re-drilled or built up to the worn side and finished with a three-fluted drill or reamer.

Equalizers come in for their share of wear, not only on the sides where stands and hangers wear them but pin holes as well.

It is important to emphasize again the fact that any spring rigging which has been welded either on account of breakage or wear, should be stress-relieved.

Brake rigging—Brake beams which are worn on the trunion

end can easily be built up by arc welding and remachined. Areas where brake rods have worn the beam can likewise be built up, as well as worn pin holes. Brake heads can be reclaimed by welding up the worn side of the pin hole. Heads that are worn by the shoe also can be reclaimed by building up.

Brake hangers are usually cast steel and when the pin holes become worn they can easily be reclaimed by welding. Outboard brake hanger posts are difficult to remove from the locomotive for re boring when the pin hole becomes worn, and welding the pin hole while the hanger post is in position affords considerable saving.

Radial buffers and chafing irons—A lot of wear is found on the various types of radial buffers and chafing irons. A wear-resistant electrode should be used in building up the worn surfaces, after which it can be polished with a portable grinder.

Fire doors—Worn guides, pins, and pin holes can be welded in the reclamation of these parts, as well as cracked doors. It will be found that the use of welding and bronze is more practical than the arc method in the reclamation of the doors.

Driving and other spoke-type wheels—The welding of broken spokes in driving, trailing, or engine truck wheels, is widely practiced. When a weld is to be made on a spoke it is advisable to cut through the rim with a cutting torch, on either side of the spoke to be welded. This will allow for expansion and contraction. When the weld in the spoke is completed, the rim is then welded and the wheel center remachined.

Crank pin holes in driving wheel centers which become enlarged to the maximum diameter can be satisfactorily reduced by the arc method.

Wheel centers can be built up to the maximum size by the use of either of the following methods:

1—In small shops where the use of an automatic welding head cannot be justified, it is common practice to weld plates to the original wheel rim. These plates are usually made in sections, 30 to 36 in. long, approximately $\frac{1}{2}$ in. wider than the width of the rim, with $\frac{3}{4}$ -in. holes drilled approximately every 4 in. longitudinally. The plate is then formed to the radius of the wheel center and clamped to the rim by the use of C-clamps. It is then welded through the holes, which are sometimes countersunk, and along the rim, which is usually chamfered before application is made. The wheel is then placed in the wheel lathe and remachined to the original diameter.

2—In shops having an automatic welding head, the wheel is placed in a wheel lathe, the automatic welding head set up, and the required amount of metal deposited on the rim automatically. Bare electrodes are usually used in this process, there being quite a difference in cost, compared to a shielded electrode. A bare rod gives all the strength and density necessary in this case.

Hub liners can be attached to the wheel center by welding, usually through holes drilled in the plate itself and around the edges of the plate. Abrasive-resistant steel is used for the plate itself, and mild steel electrodes are used in the welding.

Driving boxes—Driving boxes with worn shoe flanges are easily reclaimed by arc welding. Abrasive steel saddle plates may be applied to the top of the driving box by drilling two $\frac{1}{4}$ -in. holes through the plate and welding through these holes.

Fractures in the box are often welded. Shoe liners, if of steel, can very easily be attached to the box by welding at each end and through holes drilled in the liner, but I believe the greatest saving realized on a driving box is through the application of a bearing metal on the hub face. This procedure in itself is of enough importance to justify a paper.

Hub liners have been a source of trouble and expense, and the practice of applying cast hub liners is not always satisfactory. It is not only difficult to get a good bearing but it is difficult to fasten them to the box so that they would not break.

On those roads which fuse the hub liner material to the box it is found that they seldom have to drop wheels for excessive material.

A type of material found most successful consists of 96 per cent copper, 3.5 per cent silica, and 0.5 per cent tin. In service this not only showed the least amount of wear, but was most economically applied, and affected the structure of the metal in the box the least. The material was applied through the rod-arc method, although a good many roads find it more economically applied through the use of a carbon arc. The material is furnished in sizes ranging from $\frac{1}{4}$ -in. to $\frac{3}{8}$ -in. diameter, and when used with the metallic arc method is applied with reverse polarity, but when applied with carbon arc method, direct polarity is used.

One road uses $\frac{3}{4}$ -in. carbon and $\frac{1}{2}$ -in. rod size, using an amperage of 500 to 600 and direct polarity of 40 to 45 volts.

Size and construction of the box must be considered, and the heat kept as low as possible; otherwise, some distortion will be noticed in the box.

Other metals, such as those containing lead, in proportion of 80 per cent copper, 10 per cent tin, and 10 per cent lead, and 88 per cent copper, 10 per cent tin, and 2 per cent lead, were also tried, but did not give as good results as were attained with the copper-silica-tin formula previously mentioned.

In the study of grain structure of the cast steel surface of the box, it was found that the bearing metal deposited showed but little iron, and that only in immediate vicinity of the fusion point. The grain structure in the metal of the box itself was not effected more than $\frac{1}{16}$ in. from the bond.

The machinability of this metal is good, and cutting speeds as high as 265 f.p.m. can be used.

The real economy in this type of hub liner is that when locomotive goes through the shop none of the metal left on the box is lost. It is only necessary to replace that which has been worn off. The fact should not be overlooked that the locomotive is rarely out of service between shoppings because of worn hub liners.

Some novel positioners have been developed to handle driving boxes. Usually the positioner consists of a turntable which will support the box at an angle of approximately 10 deg. This enables the operator to apply the metal much faster.

It is that an exhaust system be provided to carry away the gases created by welding. In using rods of this size it is necessary to use a water-cooled electrode holder.

Engine truck boxes—A saving can be effected by brazing the cast brase liners to the box in two or three places. This protects against the loss of part or all of the liner in event that it loosens on the box.

Where babbitt is used, such as Satco, bronze or steel screens are usually welded to the box before the application of the metal. This is best accomplished by the use of gas.

Where floating liners are used, wear-resistant steel can be successfully welded to the box. This affords greater wearability.

Pedestal wear, equalizer wear, and oil cellar groove wear can also be corrected by welding.

Engine truck frames—Most engine truck frames are of cast steel, and many times are fractured. Centering devices of the rocker type can be built up with wear-resisting metal which will last even longer than the original.

Locomotive piping—Although it is necessary that many removable joints be included in the piping of a locomotive, so that pipe may be removed to get at various other parts of the locomotive, a good many of the threaded joints can be eliminated by welding. It is found advisable, many times, to weld half of a coupling to a pipe, rather than to use a tee. This does away with two threaded joints. As boiler pressures go higher some alloy steel piping will be used. In such event considerable welding will be used.

Superheater units—It is possible to reclaim many superheater units which are not worn to the limit requiring the scrapped. New joints ends and return bends can be applied; spots where cylinder cutting has taken place can be built up and bands can be applied by welding rather than through use of rivets. This will probably give twice the service of the riveted band.

It is also advantageous to apply a small dot, or button, to the unit where the band is applied, so that the hole in the band may fit over this button and prevent it from slipping.

Crossheads and guides—Crossheads with enlarged shoe bolt holes can be reclaimed by countersinking and welding in a tapered plug. Cracks outside of the critical area can be welded, and if the crosshead is stress-relieved, it is as good as new. Enlarged guide bolt holes may also be plugged by the same method.

Valve gear—Although the welding of valve gear is frowned upon by most mechanical engineers, there are many instances where the application of silico and manganese bronze will prevent lateral wear.

Discussion

What discussion there was on this report concerned the matter of stress relieving welded parts and one forge-shop supervisor drew attention to the fact that, in stress relieving, the temperature of the surface of the metal should never exceed the temperature

at which structural change takes place in that metal. This member concluded his remarks by emphasizing that the final job of stress relieving should never be a hurried one; to try to rush the job through—no matter how bad the shop needs the part—will only end in a failure of the part.

Developments in Modern Tooling

When consideration was given to the subject matter for the report of this committee for the year 1946 opinion was that in view of the acquisition by the railroads of a considerable number of new machine tools during the years 1944 and 1945 a continuation of the investigation into the influence of carbide cutting tools would be distinctly worth while. It, therefore, develops as somewhat of a paradox that while there has been a considerable expansion in the use of carbides in the machining of locomotive parts the definite performance data available as a result of such expansion has not been forthcoming as in previous years.

Actually, data are available on 12 different jobs performed in the shops of 8 different railroads. The classification of the jobs as



E. A. Greame,
Chairman

to type of work is as follows: boring tires—5; rod bushings—3; frame bolts—1; driving box brasses—1; gun iron bull rings—1, and cast steel wheel centers—1. There is one thing in common in the data available for the preparation of this report and that is that most of the information that it was possible to get from railroad sources was incomplete for three general reasons: (1) lack of definite time-study data on the performance of cutting tools before the adoption of carbides; (2) lack of time-study data on existing jobs because the output on many new machines has not yet reached the desired rate, and (3) unwillingness to provide data on existing operations because shop supervisors are conscious of the fact that the new machines, in many cases, are not being used to capacity, through one reason and another.

However, there is sufficient information to draw conclusions with respect to the use of modern cutting tools. First among these conclusions is the fact that the experience of most railroad machine shop men has been that where carbides have been used on a job to which they are suited and on a machine in good physical condition the performance has been such as to emphasize the distinct advantage of carbides in the matter of quality of finish, machining time and the ultimate life of the tool between grindings. There are many jobs on which carbides are used, or can be used, in which the major beneficial result may be quality of finish or increase of tool life between grindings rather than the reduction of machining time. Properly set up, however, almost any job, by comparison with an older machine, can be done at a substantial reduction of floor-to-floor time if the machine is operated at maximum permissible speeds and feeds. Many of the new machines that have been installed in railroad shops within the past two years are still not being used at anywhere near the capacity built into them.

In Table I are a few of the production figures that came to the attention of the committee.

The report was signed by George E. Bennett, master mechanic, C. & E. I.; M. A. Thompson, foreman welder, B. & M.; Ralph E. Fagerberg, motive power inspector, Alton; Harry M. Moreland, welding supervisor, C. & O., and Emerson Murray, welding instructor, C. & E. I.

Use of carbides and hydraulic controls on machine tools open way to reduced machining time

A carbide tool and holder has been developed and tested in which the tool tip is held in position by a spring steel clamp, firmly supported. These tools are well adapted to the older machines where there is back lash, stalling under pressure of cut or

Table I—Production Data on Locomotive Parts

Operation	Cutting Tool Used	Machining Time	Pieces Between Grindings
Bore—56-in. tires	Carboloy	16 tires in 8 hr.	4 to 8 tires
Bore—36-in. tires	Vascoloy	14 tires in 8 hr.	4 to 5 tires
Bore—62-in. tire	Kennametal	17 min. as comp. with 45 min.	4 tires
Turn tapered frame bolts	Kennametal	4 min. per bolt	1,500 bolts

intermittent cuts. Under these conditions the tip will usually lift and bend back the spring clamp instead of breaking off. Some

Table II—Performance Data with Spring Type Tool Holder

Operation	Cutting tool used	Machining time H M S	Former mach. time H M S	Pieces between grinds	
				New	Old
Turn and bore packing ring tub	Kennametal	0-40-0	1-15-0	2	1
Turn crown brasses	Kennametal	0-40-0	1-00-00	16	4
Turn and bore piston bull ring	Kennametal	1-30-0	3-30-00	6	1
Turn and bore valve bushings	Kennametal	1-20-00	2-15-00	8	1
Bore, turn and face 40-in. Diesel wheels	Kennametal	2-30-00	4-30-00	5	1/2

performance data on a 17-year-old 54-in. Bullard vertical turret lathe using the above tool is shown in Table II.

Developments in Shop Tools

It was to be expected that the intensified effort toward maximum production in industrial plants during the war would result in many developments in machine tools and accessories that would be of value in railroad shops. Due to the disturbed conditions in industry during the past year many of these developments have been slow in coming to our attention.

All of us are familiar with the development of hydraulic drives as applied to machine tools but in appraising the advantage of hydraulic drives it has sometimes been overlooked that the introduction of the hydraulic drive has also made possible many other developments in machine tools and their use that would not otherwise have come about. Various types of automatic duplicating devices are now available on milling machines, engine lathes, turret lathes and drill presses that not only simplify the repetitive production of locomotive parts at a considerable time reduction but also assure that degree of accuracy so necessary for interchangeability. And, from the standpoint of railroad work several of these devices are in the form of attachments that may be added to existing machines where it is in such physical condition as to warrant the application of additional expensive tooling equipment.

One such development brought to the committee's attention is a hydraulic duplicating lathe the function of which is to reproduce rapidly and accurately, from a template mounted on a holder attached to the rear of the lathe, such work as spindles, motor shafts, valve stems, piston rods, throttle stems, or any other shaft having

an irregular contour. It will reproduce steps, tapers, right-angle or tapered shoulders, recesses, grinding necks and radii. In the case of this duplicator there are no stops to set and no multiple tooling to bother with. The lathe cuts metal continuously and does not have to be stopped for measuring or calipering. Measuring is confined to the first diameter only, after which all other diameters are reproduced automatically. Some idea of the productive possibilities of this duplicating lathe may be seen in the reduction in machining time on a locomotive piston rod from 4 hours to 34½ min., and the machining of a valve stem in 22¼ min. that formerly took 3 hr. 15 min.

Another device having a number of possibilities in the field of drilling is an automatic spacer which completely eliminates the conventional drilling jig, or the necessity of laying out each individual piece, where several pieces, having duplicate drilling are involved. This drilling spacer consists of a flat table that is set up on the table of the drill press or radial drill and with the work clamped in place the table is traversed hydraulically from one predetermined position to another by means of two selector controls—one for lateral positions and the other for longitudinal positions. The table movements are actuated by hydraulic cylinders and the number of positions depend on the number of cylinders used in each of the two directions; thus if there were 10 cylinders used in the longitudinal and 10 cylinders in the transverse movement a total of 100 positions would be available. Some idea of the accuracy of this device may be gained from a job in which four holes were drilled in a piece of ¾-in. steel; the spacer positions were set and then four more holes were drilled in second piece of ¾-in. steel. The first plate was then placed on top of the other and four steel pins, super-finished to a diameter of .0005 in. less than the holes, were inserted. The holes matched perfectly and a slight vacuum was created when they were withdrawn. As to time saving: on a lot of 74 pieces requiring 70 hours for drilling with a jig, the spacer cut 10 hours off the time and eliminated the \$350 jig.

These are but two of many developments in machine tools that will be available in the future for cutting the cost of production and the time required for the machining of locomotive parts.

Conclusion

The study in connection with this year's report leads to certain rather obvious conclusions. Of paramount importance is the fact that the railroads, because of greatly increased labor and material costs, are faced with a period in their history when the cost of operation must be held to an absolute minimum in order to maintain solvency or to assure profitable operation. The cost of locomotive repairs is still the largest single item of operating expense and, in so far as steam locomotives are concerned, the expense of machine shop work represents from 15 to 20 per cent of the cost of back shop repairs.

Unfortunately locomotive parts are not produced in great quantities and therefore, in many instances, the economies that might be expected as a result of modern quantity production are not

available under present circumstances. With modern machine tools and modern cutting tools offering economies in quantity production it may be worth while to explore the possibilities of increasing the number of any one locomotive part produced on any one shop order by anticipating requirements for longer working periods. For example, most every railroad has certain locomotive parts which, over a period of six months or a year, might require the manufacture of 300 to 500 pieces in the machine shop. On most roads, these are not made at one time but are produced on shop order as needed. With the economies of turret lathe work and hydraulic duplicators such as have been mentioned it has been found possible, in some cases, to produce parts for one-half or two-thirds the machining cost per piece when produced in large quantities.

The installation of machine tools, such as horizontal boring mills, with general purpose possibilities should be studied in the light of modern machine and tool developments with the idea of eliminating many of the older single-purpose tools and their attendant high production costs.

Discussion

The discussion on the shop tool report centered around the use of carbides. One member said that experience has demonstrated that while there are few jobs that can not be done with carbides, not all jobs are practical for carbides. Tool grinding, he said, is a very important factor in tool performance. This member, as an example, cited the boring of from 500 to 600 cast iron wheel per tool grind and concluded his remarks by saying that while carbides were once considered practical mainly for turning operations they are now widely used in boring, reaming and milling operations with successful results.

Another member recounted experience in the boring of tires in one cut, with a taper of only one to two thousandths.

Considerable discussion resolved around proper rake angle, most of which concerned the question of negative rake. While there was considerable interest in negative rake on machining jobs, little information resulted from the discussion.

Another member stated that the shop with which he was connected used carbides extensively and ventured the opinion that the machining of steel with this type cutting tool is creating the most troublesome problems, none of which cannot be overcome by study and attention to details.

Another member raised the question as to the use of carbide-insert milling cutters on multiple-bar guides and was informed that one large Eastern shop has been successfully performing this job with carbide tools for some time.

The report was signed by E. A. Greame (chairman), tool foreman, D. L. & W.; Wallace Brown, shop supervisor, B. & M.; O. L. Dean, shop superintendent, B. & Ar.; W. Leys, general foreman, G. T. W.; F. B. Rykoskey, supervisor of shops, B. & O.; J. I. Stewart, supervisor machinery and tools, N. Y. C.; F. Whitaker, shop superintendent, N. Y., N. H. & H.; E. Wynne, mechanical engineer, shop methods, Can. Nat'l., and H. C. Wilcox, *Railway Mechanical Engineer*.

Spring-Rigging Design and Maintenance

Little has been written in connection with the purpose and fundamental principles of the spring system; consequently it is generally misunderstood, resulting in abuse, improper adjustments, poor design of parts, etc., all of which leads to higher maintenance costs and reduced availability. There are many instances in which misalignment has been blamed on springs or the rigging when the real fault was elsewhere.

The purpose of the spring equalization system is: (1) to distribute the weight of the spring-supported mass of a locomotive to each axle as required by adhesion requirements and load limitations indicated by those responsible for the right of way over which the locomotives must operate; (2) to absorb shocks produced by frogs, diamonds, joints, curving, etc., and distribute them throughout, thus avoiding local overstraining; and (3) to absorb and distribute forces produced by unbalanced machinery. This is a most important function when one con-

Two-part report establishes the fundamentals of spring-rigging design, the correction of its defects as found in service and the facilities and methods of repairs

siders high rotative speeds, for it is then that vertical components of the main rods and the effect of overbalance in the counterweights for the reciprocating masses become high.

From the foregoing it is evident that flexibility is essential, yet a proper degree of stability is required to avoid derailment, fouling, local overloads, excessive rolling, bouncing, pitching, and hard or stiff riding, all of which would have unfavorable results on frames and machinery as well as to the right of way.

A proper design of springs will contribute much to obtaining satisfactory conditions and a properly designed and maintained spring rigging is a most necessary complement in order to obtain optimum results.

In order to obtain the desired weight distribution and maintain it within reasonable variations under operating conditions, it is necessary from a design standpoint that the suspension of the spring-supported mass shall be considered as being at three points. This has nothing to do with spring design or manufacture, which will be discussed later. The following concerns only the equalization systems in which the springs merely act as beams or levers.

The three suspension points are obtained by breaking up the springs and equalizers into three separate groups, the resultant point of support of each group being one of the required three points. One point must lie in the longitudinal center line of the locomotive and the other two must be in a plane at right angles to the center line, and as far out from the center line as possible. It is now apparent that if all three points were



W. H. Ohnesorge, Chairman

connected by straight lines a triangle would be formed, which is known as the resultant support triangle. It is important that the grouping be so arranged that the center of gravity of the spring supported mass will lie well within the triangle, and quite remote from the apex. The nearer this center of gravity is to the sides or the apex, the less stable is the locomotive. In general, it will be found that the center of gravity will be approximately along the center line of the locomotive, and about one-third to one-half the distance from the base to the apex of the triangle. The grouping should be such that the resultant support triangle will have that relation to the center of gravity of the spring supported mass. It is customary and usually more convenient to have the apex of the triangle toward the front of the locomotive, although there would be no objection technically if it were the opposite.

When four-wheel lead trucks are employed the resultant of the truck suspension system may be considered as being in the vertical center of the truck center plate or casting. While it is true that the center-plate bearing is not a point, its influence in preventing listing is very small. Therefore, if no other spring-rigging parts are connected to the lead truck one point of suspension will lie in the vertical center of the center plates, and form the apex of the resultant support triangle. All other springs and equalizers should then be divided into two groups, one for each side of the locomotive; and the resultant points of support of these two groups are the other two points of suspension, thus completing the triangle. Locomotives with four-wheel lead trucks have been so arranged as to include the springs of one or more pairs of drivers with the lead-truck suspension, but such an arrangement is uncommon. Unless the locomotive is of unusual length such an arrangement will bring the sides of the resultant triangle so close to the center of gravity that the locomotive probably would not be stable.

When two-wheel lead trucks are employed, it has been found to be desirable to include the springs of at least the first pair of drive wheels (and often the second pair as well) with the truck suspension system by means of a centrally located equalizer, hanger, and a cross equalizer. This arrangement places one

point of support along the center line of the locomotive, but to the rear of the truck center pin and the resultant of this group forms the apex of the resultant support triangle. All other springs and equalizers should then be divided as before into two rear systems, one on each side, thus establishing the other two points of suspension.

Having discussed the basic principles of suspension the reasons for the tilting of springs and rigging, the listing of the locomotive etc., and the correction of these troubles can be considered.

As far as weight distribution is concerned, it is important that the lengths of the equalizer arms be correct. Inaccuracies of these dimensions will act to load some journals higher than intended by design and if the inaccuracy is great enough, heating troubles will develop. The resulting change in spring loads will decrease the deflection of some springs and increase that of others, causing some tilting.

Undesirable distribution of weight may or may not be produced by tilted spring systems when tilting is caused by errors other than the above, depending upon the design of springs and equalizers, which will be discussed later.

Tilting of springs and rigging is always a result of errors in vertical dimensions of springs, rigging or related parts such as wheel diameters, boxes, saddles, etc. The effect of errors in each of the above and their correction will be discussed separately.

Wheels

The diameters of driving, lead and trailer wheels all have a definite relation to each other. The vertical dimensions of many parts of the locomotive, including spring rigging, are governed by the difference in wheel diameters. If this wheel relation is disturbed, the locomotive will not be longitudinally level and since the frame will then be inclined, the vertical relationship of fixed points of the spring systems will be changed with respect to journal centers. Since the spring seats also have a definite relation to journal centers which will not change when wheel relationships are disturbed, the springs and rigging must tilt because the relation of rigging fixed points to spring seats has been changed, unless proper compensatory measures have been taken.

In the case of four-wheel lead trucks having wheels small in relation to driving tire thickness, a shim whose thickness is one-half the error of the lead wheel diameters should be placed in the female center plate. If the lead wheels are large, one-half the diameter error removed from the center plates assembly will correct that error.

Locomotives with two-wheel lead trucks may be treated similarly when tilting is caused by improper truck-wheel diameters provided the center-pin assembly is of the design wherein the main equalizer is provided with a front hanger extending up through the center pin with an adjusting nut and screw at the top. The nut should be moved on the screw by one-half the amount of the diameter error. Unfortunately, many two-wheel truck designs do not provide a forward hanger for the main equalizer, which makes adjustments more difficult. In such cases, the rear hanger of the main equalizer may be lengthened or shortened by one-half the diameter error multiplied by the ratio of the main equalizer arms. If this hanger is of the non-adjustable type, the same change can be made by inserting wider or thinner keys in the front hangers of the springs over the first pair of drivers. Either of these two expedients will level the locomotive as well as the spring rigging.

It is most unfortunate that many designs of front hangers for the No. 1 springs are of the loop or non-adjustable type. In such a case, the adjustment can be made at the rear hangers of the No. 1 springs provided they are not of the loop type also. Adjusting at this point will level the locomotive but leave the springs and rigging tilted. If one-half of the desired adjustment (one-quarter of the diameter error multiplied by the main equalizer ratio) is applied under the No. 1 spring seat or somewhere in the box-saddle assembly, the locomotive will be level and the springs and rigging tilted only half as much as though the adjustment had been made at the rear hangers.

A locomotive having the above errors in lead wheel diameters, either two-wheel or four-wheel truck, can also be leveled by applying wider or thinner keys in every hanger of the rear systems, including trailers if any, as an alternative. Of course the change from nominal key width would be just the reverse of that indicated for the adjustment to be made at the truck

center. That is, if the locomotive is low in front because of small lead wheels, the adjustment made at the truck center is accomplished by adding material to the center plate of a four-wheel truck, or shortening the front hanger of the main equalizer or the equivalent of that in the case of a two-wheel truck, thus raising the front of the locomotive and lowering the rear.

If it is decided to level the locomotive by adjusting the rear systems as outlined above, the keys must be narrower than nominal, thus lowering the rear of the locomotive and raising the front. The change in key width must be one-half the diameter error, as before.

However, if an error exists at the lead-truck wheels, it is not recommended that corrective measures be applied to the rear systems as it is not only time-consuming and expensive but may result in bringing the top frame rails, or the pedestal caps, so close to the driving boxes as to strike when the locomotive is working and effects the valve gear. It is better to adjust by the first methods mentioned rather than by the alternative method. In some cases of extreme errors and close clearances between main frames and truck frames a combination of the two methods has to be resorted to.

If there are errors in the lead-truck assembly other than wheel diameters and it is not expedient to correct them, adjustments should be made in the same manner as though the wheels were in error, except that the whole error should be compensated for, not half of it.

It is a fallacy to attempt to correct the above types of errors by inserting wider keys (or gumps) in the trailer spring hangers only. If the locomotive is low in the back because of large lead wheels or similar causes, wide keys in the trailing hangers will raise the rear only a fraction of the increased width of key and tilt the rigging worse. To apply wide keys in those hangers when the lead wheels are small is also wrong. As before, this will raise the rear slightly when it should be lowered if anything. It should be kept in mind that large lead wheels raise the front of a locomotive and lower the rear. Small lead wheels produce the opposite effects.

When there is an error in trailer-wheel diameters compensation can be made by applying wider keys (one-half the diameter error added to nominal key width) in the trailer spring hangers, if the wheels are small compared to driving-tire thickness. When the wheels are comparatively large the keys may be reduced, but if the error in diameters is great the keys must not be reduced so much as to shear. In that case, reduce the keys as much as is advisable and reduce the distance from the journal center to the spring seat to obtain the balance if construction permits. Planing the spring band has been resorted to and is usually easier and more convenient. If all the error cannot be corrected by any combination of the above expedients, the remainder in most cases will be so slight that results will be satisfactory, though not perfect.

It would not be proper to change the key width in any other hangers, such as the post hangers, or make lead truck alterations, for that would also produce tilting, cause the locomotive to go out of level, and tilt the trailing-truck frame.

From the above it is evident that every effort to match wheel diameters will save time and trouble.

Driving Boxes and Saddles

As previously pointed out, there is a definite distance from the center of the driving journals to the pulling faces of spring hangers which should always be maintained. Any change in this distance, plus or minus, will result in changing the relationship of the spring-band seat with respect to fixed points of the spring rigging in the frame, causing that spring to tilt as well as the balance of the spring rigging. Suppose such an error exists in just one driving box and spring assembly. In addition to tilted rigging, the locomotive will be out of level longitudinally and the spring rigging on the other side will also tilt. If the error exists in one of the rear systems, the locomotive will be out of level transversely as well as longitudinally.

Errors of this type usually occur in the driving box and should be corrected by applying shims of the proper thickness in the spring saddle pockets. If the pockets are too shallow, shims or weldment can be applied to the saddle legs although this is not particularly recommended as it is desirable to keep saddles standard. If the spring seat of the saddle is of the pocket type, a shim can be dropped in and tack welded. A shim

can be welded to the spring band or wide keys applied to both hangers. Much trouble in this respect can be saved if the drawing dimension from the center of the box to the top of the saddle-leg pocket is observed when boring or re boring crown bearings. If design and construction permit, it is highly desirable to correct such an error where the error exists, leaving the other possible points of correction open to permit adjustment of variation in loaded spring heights or engine-truck wheel errors as previously discussed.

Spring Hangers

Drawing dimensions between pulling faces should be carefully adhered to as variations will cause the springs and rigging to tilt as well as cause the locomotive to be out of level. After wheeling, such errors are most difficult to determine, but once found, are easily corrected by applying wide or narrow keys in the amount of the error in that particular hanger only. To try to correct the error in one hanger by changing keys in another is erroneous.

The loop type hanger now commonly used on modern power is not readily adjusted since the spring shoes fit into slots in the spring plates and the hanger bears on a concave surface of the shoe. To adjust in a manner similar to applying wide or narrow keys would require numerous thicknesses of shoes or clips carried in stock, whereas the older conventional hanger could be more readily adjusted as keys could be readily ground or rough machined if the desired size was not available, or even cut from plate if necessary.

If shims were applied to the concave surface of shoes used in connection with loop hangers, the desired effect would be obtained but it is doubtful if they could stay in place. Hence, loop type hangers may be considered as non-adjustable and no correction is advisable where they are employed. However, shims may be applied to the spring saddle or metal removed from the spring band. It is evident that proper attention at the time of repairs will save time and trouble. This means bringing hangers back to drawing dimensions. In the event that hangers are not to drawing dimensions, the error can be overcome by applying wide or thin keys, but in so doing, there is less chance for adjustment for permissible variation in spring deflection and this practice is not recommended.

Frame Connections

The vertical distance of centers of equalizer fulcrum points, spring hanger dead ends or location of frame spring bearing points from journal centers should be maintained to drawing, otherwise the effect will be the same as though wrong length hangers etc., were used.

It is also important that truck frame connections to main frames, crossties or frame extensions are properly located with respect to journal centers, for if they are not, the truck frames will not be horizontally parallel to main frames and in the case of trailers, the springs will be tilted. Trailer-truck centering devices, the rockers on Delta type trailer frames, for example, must be the right height and the surfaces they rest on or bear against properly located with respect to journal centers.

Springs

When spring plates are formed, or bent to the curvature of master plates or other spring plates, most of the deformation is plastic, depending on the temperature and physical properties of the steel, and part is elastic. When the plate is freed from the cambering machine, it loses that part of the camber which was elastic. When a spring is reworked, the bending done by the cambering machine is less, that part which is elastic is less, and the final camber will be a little greater than that of a plate made from a new, flat bar.

When springs are reworked, a little of the surface of each plate is lost as scale, and for a very small distance under the new surface the steel will be partially decarburized; that is, it will lose a little of its carbon. This decarburized steel will offer less resistance to the bending it is subjected to in service. Portions of the plates, too, will have had their thicknesses reduced by wear. These changes have important effects on the heights of springs when applied to locomotives. For example: a spring 44 in. long, having 18 plates of $\frac{3}{8}$ -in. nominal thickness will, if the thickness of each plate is reduced by only 4 per cent, lose 0.27 in. in the height of its assembly of plates. The thin plates

will deflect 0.42 in. more under the working load, so the working height will be 0.69 in., or $1\frac{1}{16}$ in. less than it would be if the plates were of full $\frac{3}{8}$ in. thickness. When spring steel is hard to get, it is often necessary to use plates that have lost more than 4 per cent of their original thickness.

New steel will differ to some extent in its dimensions and in its resistance to bending. Bands will vary according to customary forging tolerances. From the foregoing, it is clear that all springs made or repaired to one set of drawing dimensions cannot be alike. It is surprising that so large a proportion of them do come within the tolerances. Uniformity could be gained by so making the master plates that, when the springs are tested, none are too high and those that are too low could have shims welded to the bands to bring them to the proper height. That however, is not the practice.

At the main driving wheels there is much more weight not spring-supported than at the coupled wheels, because the main wheels carry the back ends of the main rods, the eccentric cranks, the back ends of the eccentric rods, and more of the weight of the side rods than any other pair; the heaviest crank pins, crank pin hubs, and counter-balances, and often the heaviest axle and boxes. To get the maximum allowable total weight on the drivers without exceeding the limit on any pair and to secure uniform tread wear of the tires, it has become the practice to reduce the spring-supported weight on the main drivers and sometimes on the intermediate drivers of locomotives having more than three pairs. This is done by means of equalizers having unequal arms. Thus there are often four different spring loads on a 4-6-2 locomotive from the design standpoint alone. It is, of course, impracticable to use springs of four different designs to take care of these differences. So it is evident that spring rigging must be adjusted, and locomotives should be provided with means of adjustment.

Spring Shoes or Clips

Most spring shoes now in use are so designed that they cannot be gumped or shimmed without making useless the lips that are provided to hold them in place. The shoes then slide along the plates until the hangers reach the ends of the slots. The sharp edges of the slots then cut the hangers and if the result is not a broken hanger, causing a locomotive failure, new hangers will be required when the engine is repaired. It is economy to make adjustments by the substitution of keys of different widths, and the hangers should have slots long enough for such adjustment.

Another method of correction other than the employment of wide or thin keys is to manufacture the spring shoes or clips in various thicknesses which is just as effective as far as adjustment is concerned.

The end lip of clips usually used with positive camber springs should have the inside fillet as generous as possible in order to minimize stress concentrations in that area. Clips of similar design for flat or inverted camber springs, the outer surface of which bears against the upturned end of the second or third plate, should also be provided with a generous inside fillet as there is no guarantee that the direction of action will not be reversed at times.

The restraining lug of clips not employing end lips should be of generous proportions to prevent excessive wear or shearing off. It is suggested that such lugs have the same cross section and shape as a hanger and provide suitable slots in the first and second plates. Such clips are most commonly employed in connection with loop hangers or the old style two-strap hangers held together at the top by a key resting on the clip. If this style of clip is to be used on positive-camber springs it should be crowned to be certain it is supported at the center.

If a clip is unsupported at the center it may be subjected to high transverse stresses and, depending on circumstances, this stress could be greater if the thickness were increased. Considering all the factors involved it would seem to be an advantage to make the clip of a material and thickness permitting small deformations at low stress and employ wide or thin keys for adjustments.

Listing and Effect of Drawbar Pull

A locomotive having a two-wheel leading truck has a central, longitudinal equalizer extending from the leading truck to a cross-equalizer connecting the front ends of the forward driving

springs. This group of springs has little or no effect in preventing the lateral listing of the locomotives. That function must be performed by the rear groups. In order that inequality in the weights of the accessories on the two sides shall not unnecessarily overload the springs of one of the rear groups, the group should include a reasonably large number of springs. Thus, a 2-8-2 locomotive should have only the forward pair of drivers equalized with the leading truck, the three other pairs being included in the two rear groups. A 2-8-4 locomotive having all drivers equalized with the leading truck has only the trailing truck springs to oppose listing. Another objection to this arrangement arises from the transfer of load to the rear groups when the locomotive is exerting a draw bar pull.

Adjustments for Listing

When the cross-equalizer at the front drivers is badly inclined it is usually a wrong procedure to try to level it by adjustment of the front group of springs. The condition is probably caused by the listing of the locomotive and, when it has been leveled by adjustment of the rear groups, the equalizer will be found to be level unless differences between the two front driver springs cause a slight incline.

The springs of a four-wheel leading truck are, of course, usually connected by a cross-equalizer; but, as these springs have little effect in preventing listing, they are to be considered a single spring group, and listing should be corrected in the same manner as for locomotives with two-wheel lead trucks.

Adjustment for Wheel Size Variations

It is most unfortunate that locomotive builders have completely disregarded problems of adjustment. In the case of four-wheel lead trucks and any trailers, the design should be such as to permit use of largest wheels with the thinnest tires and have the springs, rigging and the locomotive level. Then when the wheel size errors reverse their trend, suitable lifts applied under spring bands and shims in the center plate, can be easily applied to obtain level conditions.

It is not clear why front equalizer hangers for the main equalizer as used in older two-wheel lead truck construction was abandoned without at least providing a satisfactory substitute.

It is believed a little study will show that a change in design of the rear or central hanger to the main equalizer of two-wheel trucks of existing locomotives will permit the use of a slot and key arrangement which will then allow adjustment for wheel sizes without getting into complications at the No. 1 driver. Changing the center pin to make room for a hanger and an arrangement may prove too complicated.

As previously pointed out, the use of loop hangers imposes severe restrictions on maintenance forces in connection with adjustments. Builders should be requested to furnish some other design of hanger that will permit adjustment as readily as the more conventional slotted hanger and key. There is a so-called three-piece hanger now on trial that permits ready adjustment yet there were no changes made in the spring plates. This type of hanger has been in service two years without failure whereas, many of the loop-type hangers furnished with the locomotives have failed.

In connection with hanger failures, maintenance forces should refrain from applying plates or gumps under spring shoes when making adjustments. The use of such plates lifts the shoes out of the slots or away from the ends of the spring plates, thus allowing the hangers to shift and contact the spring plates which not only damages the hangers severely but prevents them functioning properly and failures result.

The equalizers of any spring system should be so designed that there will be no change in the distribution of weight for any reasonable distortion of the system. This condition can be met if all members, including springs, are designed so that they have the same effect as straight-arm levers.

If the fulcrum center and points of load application all lie in the same straight line that equalizer is a straight-arm equalizer, and no matter how it is tilted, the ratio of the moment arms will not be changed, hence there will be no change in weight distribution.

If the arms of an equalizer form a V, it is known as a V-type equalizer and if such an equalizer is tilted, the ratio of the effective moment arms will vary as the product of the lengths of the arms and the cosine of the angles through which they

arms have been tilted. This will result in a change of weight distribution and the greater the tilting or the greater the inclination of the arms, the greater will be the change in distribution. Equalizers in such design should be avoided.

It will be found in most cases that V-type equalizers can be changed to a straight-arm type without too much trouble. Builders should be required to furnish straight-arm equalizers whenever possible on new power.

Driving-box equalizers, or "Dolphin Bars" are also V-type equalizers and their use should be avoided if possible.

Semi-Elliptic Springs

Semi-elliptic springs should be designed so as to act as straight-arm beams or levers. This is best accomplished by rounding the bottom of the spring band to a radius the center of which lies on or close to a straight line through the points of load application at approximately the working height.

In practically all cases a change in weight distribution will occur as the spring is tilted if the bottom of the band and the top of the spring saddle are recessed transversely for the application of a pin or roller on which the spring can rotate, as this design produces a V-type lever effect due to the fact the spring rotates about the center of the pin. Hence, as in the case of V-type equalizers, such design should be avoided. Generally, such a pin is remote from a straight line connecting the points of loading, but if a spring could be designed so that under loaded conditions, the camber was sufficiently reversed to bring the points of loading in line with the pin center, there would be no change in weight distribution as tilting occurred.

The use of dowels set into spring saddles, etc., to hold a spring in position as it tilts cannot be considered good practice. There are components acting in a direction to cause shearing of the dowels and if the resistance to shear is great enough, loose bands often result.

Articulated Locomotives

The foregoing applies in principle to articulated locomotives. There must be three resultant points of support in order to meet requirements of stability and flexibility.

Some articulated locomotives have their spring rigging so designed that there is but one resultant for the forward power unit, thus forming the apex of the triangle. The rear unit is equalized continuously, including trailers, down each side forming the other two resultant supports.

Other articulated locomotives are so designed as to consider the forward unit as entirely separate and having three resultant supports of its own. The supporting point of the forward unit forms the apex of the resultant triangle for the locomotive as a whole, the rear resultants being obtained as before by separate spring systems equalized continuously down each side of the rear power unit, including trailers if any.

From an equalization point of view, either method is suitable since the principle of three point suspension is not violated. However, the latter method offers greater stability and there would be less tendency to roll when curving at speeds.

The choice of the method to be used should be largely determined by the type of service, the relative location of the center of gravity of the total spring-supported weight with respect to apex and sides of the resultant support triangle that includes the rear unit, and the speed at which it is desired to negotiate curves. Furthermore, unbalanced machinery forces should be given consideration when deciding whether the front unit should have but one point of support or three.

Repairing Locomotive Semi-Elliptic Springs

When springs are removed from locomotives, they should be cleaned in a lye vat to remove dirt and grease before they are forwarded to the spring shop to be repaired. This makes it easier to give springs a close check and more readily to detect broken plates.

Springs with broken plates are set aside to be reworked.

These springs are handled as follows:

CHECK BAND LOCATION

(a)—Springs with bands up to $\frac{1}{4}$ in. off center are satisfactory for use provided they meet the following test requirements.

(b)—Springs with bands from $\frac{1}{4}$ in. to $\frac{3}{4}$ in. off center should

be tested, and provided they meet the following test requirements, should be rebanded and are then satisfactory for use.

(c)—Springs with bands $\frac{3}{4}$ in. and more off center should be given a rigid inspection and if leaves are in good condition, proper shape and thickness, can be rebanded, then must meet the following test requirements before being used.

SPRING TESTS

(a)—Apply test load. This should stress spring plates to 120,000 lb. per sq. in. and should be shown in pounds on the drawing.

(b)—Release test load and measure free height.

(c)—Apply working load, measure working height and compare with the drawing.

(d)—Increase from working load to test load.

(e)—Release the test load.

(f)—Measure the free height and compare with the free height obtained in (b). The second free height should not be more than $\frac{1}{32}$ in. less than the first free height. If this difference is more than $\frac{1}{32}$ in., apply test load again and check the free height for further permanent set. If any further permanent set occurs, the spring should be rejected, and if no further permanent set occurs, the spring is satisfactory.

(g)—The hammer test will indicate loose bands and plates that are broken inside the band. These springs are rebanded, applying new plates where necessary and the spring is again tested as above.

LUBRICATION OF SPRINGS

The spring is then immersed in a tank of light or medium oil (good commercial rust preventative is recommended) allowing it to soak for two or three minutes. It is then removed and placed on a rack to drain. Tag the spring with working height and place in stock.

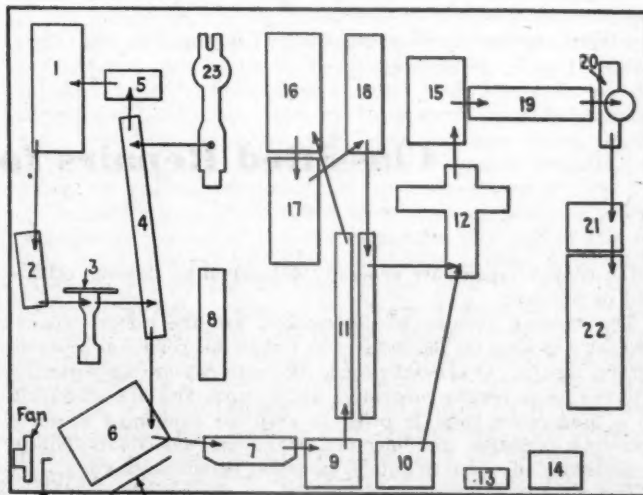
Reworking Semi-Elliptic Locomotive Springs

(1)—Material specification: (a)—Spring plates, A. A. R.-M 112; (b)—Spring bands, A. A. R.-M 302—Grade A.

(2)—Dismantle the spring.

(3)—Gauge the plates. All undersize plates should be rejected in accordance with the following: $\frac{1}{4}$ -in.—0.240 min.; $\frac{3}{8}$ -in.—0.360 min.; $\frac{7}{16}$ -in.—0.420 min.; $\frac{1}{2}$ -in.—0.480 min.; $\frac{5}{8}$ -in.—0.600 min.

(4)—Replace plates that have been rejected. (a) Cut to



- | | |
|---------------------|-------------------------------------|
| 1—Punch and shear | 12—Hydraulic spring-banding machine |
| 2—Furnace | 13—Cooler |
| 3—Nibbing machine | 14—Oil cooler |
| 4—Assembling rack | 15—Band quenching tank |
| 5—Furnace | 16—Heat-treating furnace |
| 6—Forming furnace | 17—Oil quenching tank |
| 7—Cambering machine | 18—Tempering furnace |
| 8—Master plate rack | 19—Rack |
| 9—Cooling rack | 20—Hydraulic spring tester |
| 10—Band furnace | 21—Oil tank |
| 11—Piling racks | 22—Drain tank |
| | 23—Band stripping machine |

Arrangement of a modern spring shop and sequence of operations

correct length. (b) Nib plates to A. A. R. standard nibs. (c) Punch slots were used. (d) Place plates on the rack for fitting.

(5) The complete spring is placed in the furnace with leaves at least $\frac{1}{2}$ -in. apart to facilitate uniform heating. Heat uniformly to 1600 deg. F. and hold for approximately 35 min. (This is comparable to one hour per inch of thickness commonly used.)

(6)—Form the chamber. Spring plates should be fitted to master plates. The less nip the better.

(7)—Place the spring plates on the cooling rack. Allow to cool to black heat before placing on the piling rack.

(8)—Place the spring on the piling rack in complete spring sets. Allow to cool completely.

(9)—Place spring plates in the furnace as a unit with the leaves at least $\frac{1}{2}$ -in. apart to facilitate uniform heat. Heat uniformly to 1500 deg. F. and hold for approximately 35 min.

(10)—Remove the spring plates from the furnace and quench in oil. The temperature of oil should not exceed 150 deg. F.

(11)—Remove the spring plates from the oil and allow to drain.

(12)—Place the spring plates (as a unit) in the tempering furnace with the leaves $\frac{1}{2}$ -in. apart and heat uniformly to 300 deg. F. and hold for approximately 23 min.

(13)—Remove the spring plates and place on the cooling rack.

(14)—Remove scale from the spring plates when cool.

(15)—Heat and apply the band to the spring.

(16)—Remove the spring from the banding machine and quench the band.

(17)—Test the spring as previously described.

(18)—Lubricate the spring as previously described.

The above temperatures and times are based on using furnaces of 900 lb. to 1000 lb. capacity to obtain Brinell hardness of 370 to 440. The preferred Brinell hardness is 400.

Spring-Shop Equipment

Combined shear and hot punch having shearing capacity to handle $\frac{3}{4}$ -in. by 8-in. cold spring steel and $1\frac{1}{2}$ -in. by 10-in. hot spring steel. Punching capacity, $1\frac{1}{8}$ -in. x 7-in. oblong through $\frac{3}{4}$ -in. thick in cold spring steel and $1\frac{1}{8}$ -in. by 7-in. oblong through $\frac{1}{2}$ -in. thick in hot spring steel.

Nibbing machine capable of producing AAR Standard nibs in $\frac{5}{8}$ -in. spring steel.

Nibbing and punching furnace, open top with opening 42 in. long by 5 in. wide at one end and a section 8 in. wide and 12 in. long at the other end for heating plate ends for punching. This furnace may be oil-fired with manual control.

Plate forming furnace, approximately 3 ft. by 6 ft.; 1,000 lb. capacity; oil fired with automatic recorder control and audible signal.

Elliptic spring forming machine, $\frac{5}{8}$ -in. by 7-in. by 72-in.

capacity; chain belt type; air operated.

Quenching furnace, the same as the forming furnace.

Oil cooling bath, a tank 42 in. by 84 in. by 48 in.; 25 g.p.m. pump; using any standard quenching oil kept at 150 deg. F. by suitable cooling system; thermometer control.

Tempering furnace, the same as the forming furnace.

Hydraulic banding press with assembling table, capacity 33-47 100 tons.

Oil-fired banding furnace, 3 ft. by 3 ft. by 3 ft. with manual control.

Band-quenching tank, 3 ft. by 6 ft. by 2 ft., using oil quench for steel bands and water for wrought-iron bands.

Spring testing machine, 35 tons capacity; 78-in. by 22-in. table.

Spring lubricating tank, 50 in. by 60 in. by 26 in.

Hydraulic spring stripping machine, 100 tons capacity.

Hydraulic system, designed for operation at 1,500 lb. pressure.

Hardness testing equipment for checking processes.

Discussion

One member stated that the first requirement for good springs was a steel of high yield strength in order to obtain a high elastic ration and that the attainment of this high elastic ration was dependent upon the material being free from stress-stretched heating. This member was in favor of oil as a quenching medium instead of water. He continued the discussion by citing the materials and methods in use on his road and laid particular stress on the fact that alloy steel is used for springs and that the metal is heated in from two to three hours and then held at this temperature for this same length of time. On that road the greatest difficulties are experienced with engine-truck springs. While driving springs frequently run 500,000 miles, the maximum for engine-truck springs is around 100,000 miles.

Another member called attention to the effect of improper weight distribution, citing that the effect of a spring band 1 in. off center resulted, in one case, in an overload on the leading truck of four to five tons, causing the engine-truck bearings to run hot. He also warned against "gumping" springs to adjust coupler height and advocated the use of adjustable couplers, not the spring rigging, to correct for changed engine trucks.

Another member strongly recommended the adherence to blueprint dimensions by the back shops and that the shop make sure the locomotive is level when it leaves the shop in order to save time and trouble for the enginehouse forces.

The report was signed by W. H. Ohnesorge, shop superintendent, B. & M. (chairman); L. B. Herfurth, forging sup't. M. P.; E. J. Hausbach, shop sup't, Wab.; J. A. Welch, shop sup't, I. C.; J. W. Mason, ass't master mechanic, C. of Ga. and L. M. Morris, master mechanic, W. P.

Classified Repairs for Diesel Locomotives

Locomotive repairs are generally designated as running, classified or accident.

The running repairs on locomotives are the minor repairs necessary to keep the locomotives in serviceable condition between general repairs. On Diesel-electric locomotives these are normally referred to as routine preventive maintenance and are scheduled on a progressive basis in order to keep the equipment in good operating condition and maintain maximum availability which is necessary in order to obtain minimum maintenance costs.

The routine maintenance scheduled on the progressive basis usually consists of periodical inspection and repairs to the pieces of equipment on the locomotive requiring the most frequent attention, and do not include the removal and general overhaul of Diesel engines, main generators and many other pieces of equipment on the locomotive due to the fact that such repairs are very costly and economics demand that the frequency for making them should depend entirely on the condition of those parts. Experience to date indicates that Diesel engines and main generators will operate satisfactorily for several years before removals for overhaul are necessary and that their condition is dependent upon the quality of the maintenance and the severity of the service during that period. Proper progressive

Report suggests the possibility that classified repair system is necessary and proposes outline

maintenance and operation will prolong the overhaul periods of power plants and are necessary to bring about minimum maintenance costs. The design of the main power plants is generally such that it is considered practical to overhaul the engine and generator at the same time, in order that both pieces of equipment will be good for equivalent periods of service.

Progressive maintenance eliminates the necessity for frequent shopping of Diesel-electric locomotives. However, the necessity for general overhaul of the power plants and other parts of the locomotive, accidents and wrecks require shopping the locomotive. When this is done, it is necessary to have some means of identifying and classifying the repairs to be made.

Classified repairs on locomotives consist of the general heavy repairs which are segregated into groups and are performed at certain specified intervals which vary according to the type of

locomotive and service and are utilized to measure the general condition of the locomotives. Originally there was no standard classification of locomotive repairs, nor was there any uniform standard of performance to measure the condition of locomotives and many roads had their own classification of repairs. About 1924 the ARA, now the Association of American Railroads, adopted the United States Railroad Administration Classification of repairs and established a standard for steam locomotives.



T. T. Bickie,
Chairman

However, there was no definite cycle of application established for the several classes of repair nor a definite mileage performance between the several classes of repair. The AAR Standard Classification of Locomotive Repairs appears on the reverse side of the AAR Locomotive Equipment Condition Report, AAR Form CS-56 and reads as follows:

Standard Classification of Repairs to Locomotives and Tenders

Class 1—New boiler or new back end. Flues new or reset. Tires turned or new. *General repairs to machinery and tender.

Class 2—New firebox, or one or more shell courses, or roof sheet. Flues new or reset. Tires turned or new. *General repairs to machinery and tender.

Class 3—Flues all new or reset (superheater flues may be excepted). Necessary repairs to firebox and boiler. Tires turned or new. *General repairs to machinery and tender.

Class 4—Flues part or full set. Light repairs to boiler or firebox. Tires turned or new. Necessary repairs to machinery and tender.

Class 5—Tires turned or new. Necessary repairs to boiler, machinery and tender, and including one or more pairs of driving wheel bearings refitted.

*General repairs to machinery will include driving wheels removed, tires turned or changed, journals turned, if necessary, and all driving boxes and rods overhauled and bearings refitted and other repairs necessary for a full term of service. (Under-scoring supplied.)

This classification is an effective means of controlling steam locomotive condition and something similar should be utilized for controlling the condition of Diesel-electric locomotives. The following is offered as a method which could be used for identifying and classifying the work when a Diesel-electric locomotive is shopped:

Class 1—Removing, overhauling, replacing all Diesel engines, main generators, steam generators, trucks, traction motors, wheels, general overhaul of car body, painting interior and exterior of locomotive and general repairs to all electrical and other equipment.

Class 2—Removing, overhauling, replacing two Diesel engines and main generators and general minor repairs to other parts of locomotive.

Class 3—Removing, overhauling, replacing one Diesel engine and main generator and general minor repairs to other parts of locomotive.

Class 4—Removing, overhauling, replacing two Diesel engines and general minor repairs to other parts of locomotive.

Class 5—Removing, overhauling, replacing one Diesel engine and general minor repairs to other parts of locomotive.

Class 6—Removing, overhauling, replacing all trucks, wheels

and traction motors and general minor repairs to other parts of locomotive.

The symbols (A) or (B) may be added to the classification numbers to indicate special repairs, (A) to indicate repairs on account of accident from derailment, collision or man failure—such as overloading main generators or traction motors or damage from low oil pressure and excessive temperatures from man failure; (B) to indicate repairs due to additions and betterments.

A locomotive should be classed as having received "Shop Repairs" if it shall have had at a single shopping any one of the six classes of repairs specified above, and all other repairs should be classed as "Running Repairs" and handled on a progressive basis, as specified in the routine maintenance schedules. The foregoing classifications should apply to each detention of a locomotive for these repairs regardless of where they are made.

Due to Diesel-electric locomotive units consisting of one or more power plants composed of an engine and generator, and the general design of these locomotives, it is deemed necessary to establish individual group classifications along those lines to allow for flexibility and attempt has been made to do this in foregoing classifications.

The required frequency for making the above classified repairs should be based on satisfactory performance expressed in miles or time intervals and in order to determine this, it is suggested that an analysis be made of the performance of each type of locomotive over a period of several years, taking into consideration the type of work being performed.

It is also suggested that the accumulation of mileage made and credited to a locomotive be stopped when the locomotive receives Class 1 repairs as specified in the foregoing, inasmuch as a locomotive receiving such repairs should be considered comparable to a new locomotive.

In order to have current information to control the general shopping of locomotives, it is necessary to maintain monthly locomotive condition reports pertaining to those repairs, and it is suggested that the locomotive condition records be tabulated monthly to indicate the amount of unused service remaining before classified repairs will be required.

When classified repairs are completed on a locomotive it is necessary that information be rendered to all concerned to indicate the work performed on the locomotive, plus any additional information desired, such as cost of repairs, etc.

(Note—Included in the report, but omitted here because of space limitations, was a ten-sheet sample form used in making reports of the repair work on a Diesel-electric locomotive. These forms take advantage of the fact that all of the working parts of the locomotive are identified, usually by serial number, and the report indicates, in individual cases, whether the part was replaced by a new one, examined, reconditioned, cleaned, welded, adjusted, tested, lubricated or painted. All the parts of the engine and auxiliaries, electrical equipment, controls, running gear, brake equipment, etc. are shown, by part name, on the forms with space provided for the entry of symbols indicating, as above, the attention that the part received.—EDITOR.)

Classified repairs necessitate holding locomotives out of service considerable periods of time for completion and due to this reduce the locomotive availability during that time, resulting in expensive repairs and for that reason must be made wisely or the maintenance costs will be excessive; however, with good progressive maintenance to prolong the necessity for general overhauls and the use of well trained and competent inspectors and supervisors to determine when general repairs are necessary, it should be possible to make classified repairs on an economical basis, maintain the Diesel-electric locomotives in good operating condition and know the general condition of the locomotives.

When Diesel-electric locomotives are shopped for general repairs, many different types of material are required which are not commonly stocked for running repairs and before a classified repair program is placed in effect a careful survey should be made of the material requirements and necessary arrangements made to secure this material before locomotives are removed from service, otherwise considerable delay will be experienced waiting for material which will reduce the availability of the locomotives and reflect on their overall performance.

Discussion

There was a short but pointed discussion following the presentation of this report and it was evident that there was little

general enthusiasm for the idea of setting up a classified-repair system for Diesel-electric locomotives. One or two members felt that the time had come when some regular classification should be established similar to that for steam power but other members emphatically offered opinions that to do such a thing would merely place around the Diesel locomotive some of the handicaps that are now preventing greater utilization of steam power. One member pointed out that when a Diesel engine will run two million miles, with trip-by-trip inspection and maintenance and electrical equipment will operate, say 750,000 miles by the same type of maintenance, the wide variation between the serviceability of the several parts of a Diesel locomotive, all of which are readily replaceable without tying up the entire locomotive for any great length of time, precludes the idea of ever shopping

Diesel locomotives on a locomotive-mileage basis; to do so, he suggested, would only increase the cost of repairs.

The report was signed by T. T. Blicke, supervisor Diesel engines, Atchison, Topeka & Santa Fe (Chairman); T. Thomas, supervisor Diesel locomotive maintenance, New York Central; Paul H. Verd, master mechanic, Elgin, Joliet & Eastern; E. J. Feasey, chief inspector of Diesel equipment, Canadian National; R. I. Fort, mechanical inspector, Illinois Central; R. W. Murray, general supervisor of Diesels, Seaboard Air Line; H. D. Parker, general Diesel supervisor, Atlantic Coast Line; R. G. Tausch, Diesel Supervisor, Great Northern; H. C. Taylor, Diesel superintendent, Southern Railway; J. H. Whipple, Jr., superintendent of Diesel equipment, Denver & Rio Grande Western, and W. Prescott Miller, Diesel supervisor, Chicago & North Western.

Safety in the Shop and Enginehouse

The foremost duty of the safety department is to sell safety to management and supervision. Selling safety is no different from selling any other commodity, except that there is a difference in the buyers and consumers. The salesman must know his commodity. Having convinced management and supervision that a safety program is essential, the next step is to assist supervision in the sale of the idea to the worker. Safety education means an effective instruction program, and here the safety department can be of great assistance. The safety department should assist supervisors in instructing employees in understanding the rules. This can be done by furnishing data, literature, strip

Management, the supervisors, the employees and the shop committees must all play part to assure success of program

It is the foreman's job to teach as well as tell. New men should command special attention. Corrective action should be taken before an accident occurs. Every foreman should have complete knowledge of the basis of accident prevention in general, and of the specific hazards of his department in particular.



W. H. Roberts,
Chairman

The Shop Committee and the Program

The activities of the shop safety committee are the backbone of a good safety organization, provided the committee is so organized and endowed with sufficient authority to properly function to the extent that they have prestige to command the respect of their supervisors and employees. The greatest asset in this movement is teamwork and co-operation between worker and supervision, which is essential. Endeavoring to attain this teamwork, safety committeemen should be selected or chosen by fellow workers to act in their individual crews and gang. The one chosen must be aggressive, not afraid to warn his fellow workers of hazardous operations. He must report all who do not heed his warning. All recommendations from committeemen should be investigated promptly. The shop safety committee does not relieve supervision of the responsibility of accident prevention.

The Employee and the Program

Although the responsibility for a good working accident prevention program lies directly with supervision, the degree of success with which it operates depends on the cooperation of the workman. The importance of the employee's position is suggested by the fact that over ninety per cent of accidents involving railway employees result from failure to follow safe and proper procedure, either on the part of the employee injured or some fellow employee. Knowledge of safety rules and obedience to them are the most important responsibilities of the worker. Safety rules are not just some hard and fast rules picked out at random by management, but on the contrary, the employees should realize that these rules are the result of a careful study of the causes of the most common and serious accidents that have happened on railroads. For every safety rule that a workman is asked to learn to obey, someone has paid the price of pain, misfortune or perhaps death.

The report was signed by William H. Roberts (Chairman), Supt. of Safety, Chicago & N. W. Ry.; G. A. Robinson, assistant general safety agent, C. & O.; H. H. Magill, superintendent, Chicago & N. W. Ry., Norman Peterson, assistant shop superintendent, Boston & Maine; J. L. Chapman, machine and erecting foreman, Illinois Central, and O. B. Cavanaugh, master mechanic, Northwestern Pacific.

films, motion pictures, speakers and other helps for safety meetings; provide literature and posters for bulletin boards; make periodical inspections to check conditions, rule violations and unsafe acts; and investigate injuries as to cause, and, when advisable, suggest changes to avoid repetition of the accident.

The Foreman and the Program

Management, supervision and worker share the responsibility in building and maintaining safety interest, but direct supervision has the greatest responsibility in building and maintaining safety interest. Failure in supervision is the direct or indirect cause of many accidents. The typical foreman surpasses in skill those whom he directs. Through knowledge of the work and machinery employed, the foreman gains the confidence of his men.

It is essentially the foreman's duty to know that his men are working safely, that their tools, machinery and equipment, as well as the premises, are as free from hazard as possible. It is just as much a part of the foreman's duty to see that the work is done safely, as it is done efficiently. Accidents happen because of lack of knowledge, or exercise of questionable judgment on the part of supervision in determining when personal supervision is required, and through failure to give adequate and explicit instructions covering the work to be performed.

Broad Program Features

C.D.O.A. Annual Meeting

AFTER a lapse of five years since the last annual meeting, the Car Department Officers' Association resumed its practice of holding annual conventions with a three-day session September 4 to 6, inclusive, at the Hotel Sherman, Chicago. Three hundred eighty-four members and guests registered.

Eight committee reports were presented during the convention on the following subjects: Interchange and Billing for Car Repairs, Chairman C. A. Erickson, general A. A. R. inspector, C. & N. W., Chicago; A. A. R. Loading Rules, Chairman T. S. Cheadle, chief car inspector, R. F. & P., Richmond, Va.; Car Lubrication Practices, Chairman K. H. Carpenter, superintendent car department, D. L. & W., Scranton, Pa.; Centralized Wheel Shop Layout and Operation, Chairman L. Topp, assistant wheel shop foreman, C. & N. W., Chicago; The future of conventional Passenger Cars, Chairman W. C. Barrer, assistant shop superintendent, C. & N. W., Chicago; Car Department Automotive Equipment—Selection, Use and Maintenance, Chairman C. C. Cowden, assistant superintendent car department, N. Y. C. & St. L., Cleveland, Ohio; Painting of Freight Cars, Chairman R. B. Batchelor, painter foreman, Wabash, Decatur, Ill.; Light Repair Track Layout, Equipment and Operation, Chairman B. J. Huff, assistant master car builder, C. & E. I., Danville, Ill. Abstracts of these reports appear below.

Election of Officers

At the close of the annual meeting, the C. D. O. A. elected the following officers for the ensuing year: President, G. R. Andersen, superintendent car department, C. & N. W., Chicago; vice-presidents, D. J. Sheehan, superintendent motive power, C. & E. I., Danville, Ill.; I. M. Peters, secretary and superintendent, Crystal Car Lines, Chicago; P. J. Hogan, supervisor car inspection and maintenance, N. Y. N. H. & H., New Haven, Conn.; G. H. Wells, assistant to superintendent car department, N. P., St. Paul, Minn.; secretary-treasurer, F. H. Stremmel, assistant to secretary, A. A. R. Mechanical Division, Chicago.

The board of directors includes the following officers, the last four of whom were newly elected at the annual meeting: F. E. Cheshire, chief mechanical officer, C. I. & L., Lafayette, Ind.; J. S. Acworth, assistant vice-president, General American Transportation Corporation, Chicago; J. A. Deppe, superintendent car department, C. M. St. P. & P., Milwaukee, Wis.; J. A. MacLean, vice-president, MacLean-Fogg Lock Nut Company, Chicago; L. H. Gillick, sales manager, Vapor Car Heating Company, Chicago; H. H. Golden, supervisor, A. A. R., interchange, L. & N., Louisville, Ky.; J. E. Keegan, chief car inspector, Pennsylvania, Chicago; G. E. McCoy, assistant chief of car equipment, C. N., Montreal, Que., Canada; J. P. Morris, general mechanical assistant, A. T. & S. F., Chicago; C. J. Nelson, superintendent of interchange, Chicago Car Interchange Bureau, Chicago; C. E. Strain, superintendent car department, P. M., Grand Rapids, Mich.; H. H. Urbach, mechanical assistant to executive vice-president, C. B. & Q., Chicago; W. P.

Committees propose revisions of rules and lubricating practice—Wide range of repair practices and facilities surveyed—Detail study of wheel-shop facilities to turn out 120 pairs of wheels each 8-hr. day

Elliott, general car foreman, T. R. R. A. of St. L., East St. Louis, Ill.; F. Cebulla, master car builder, G. N., St. Paul, Minn.; H. A. Harris, master car builder, Alton, Chicago; J. E. Goodwin, chief mechanical officer, C. & N. W., Chicago; R. Schey, superintendent car department, N. Y. C. & St. L., Cleveland, Ohio.

President Cheshire's Address

In opening the C. D. O. A. annual meeting, President F. E. Cheshire welcomed the members and asked them to stand for a period of 30 seconds in silent tribute to members deceased since the last annual meeting. He mentioned especially A. J. Krueger, who served as general superintendent car department, N. Y. C. & St. L. and acting president of the C. D. O. A. at the time of his death in October, 1945. Mr. Krueger directed the affairs of the association for the entire 3½-year period while President Cheshire was engaged in military service. His organizing ability, keen knowledge of car matters and inspired guidance were credited with being largely responsible for keeping the association alive during the lapse of several years during which no annual meetings were held.

President Cheshire also gave due credit to the officers, including vice-presidents, secretary-treasurer, executive committee and standing committee chairman and members, whose faithful work in a trying period also helped the association continue its constructive work. He specifically thanked the management and editorial staff of the technical press, including *Railway Age* and *Railway Mechanical Engineer*, for valuable support of the association's activities.

Looking to the future, President Cheshire urged all members of the association to study the new tools, appliances and materials now available for mechanical department use and make arrangements to select and utilize those which will best help railroads meet increasingly competitive transportation conditions. He urged car men to contribute within their capacity to the major railroad objective of more ton-miles per train-hour, which requires minimum out-of-service time for freight car equipment. He stressed the need for increased courtesy, safety, comfort and reliability in passenger service and said that railroad service of all kinds must be improved by the use of better tools and methods and the development of more adequate, trained mechanical forces to put these improved practices into effect.



G. R. Andersen



D. J. Sheehan



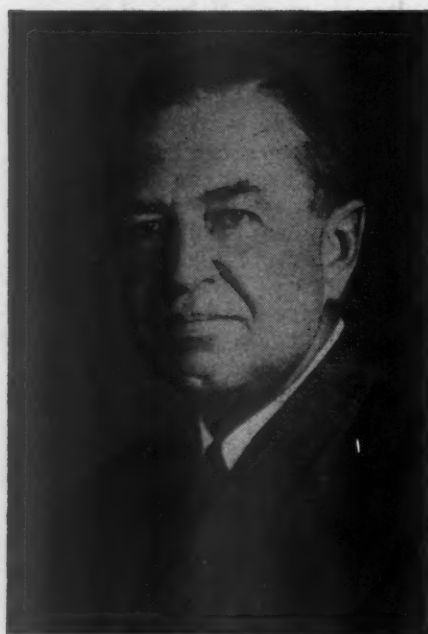
I. M. Peters



P. J. Hogan



F. H. Stremmel



F. E. Cheshire

Car Department Officers' Association

Officers

1945-46

President: *F. E. Cheshire, chief mechanical officer, Chicago, Indianapolis & Louisville, Lafayette, Ind.*

Vice-President: *G. R. Andersen, superintendent car department, Chicago & North Western, Chicago.*

Vice-President: *D. J. Sheehan, superintendent motive power, Chicago & Eastern Illinois, Danville, Ill.*

Vice-President: *I. M. Peters, secretary and superintendent, Crystal Car Lines, Chicago.*

Vice-President: *P. J. Hogan, supervisor car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.*

Secretary-Treasurer: *F. H. Stremmel, assistant to secretary, Mechanical Division, A.A.R., Chicago.*

Wheel Shop Centralization

Railway wheel shop operation has long been recognized as well adapted to modern production methods. This leads to a consideration of the desirability of centralizing wheel-and-axle work at a single shop for all but the largest railway systems, installation of the latest high-production shop machinery, tools, material handling facilities and a well-trained shop force.

The primary purposes of a centralized wheel shop are to minimize labor and transportation cost of component materials and mounted car wheels, effect uniform flow of all materials processed in such shop and establish maximum precision production. It is a definite advantage to have a centralized wheel shop, such as that proposed in this report, located at a strategic point servicing the largest freight-car repair and interchange point, on the railroad. The saving involved will include the cost of labor required in the loading, unloading and transporting of mounted wheels.

It is estimated that the requirements of this car repair yard will be 40 per cent of the total wheel-shop output. The production of this shop will be 100 pairs of newly-mounted wheels, exclusive of both wheel and journal lathes which will produce an additional 20 pairs or a combined total of 120 pairs of wheels

Hypothetical shop produces 120 pairs of wheels a day, 48 for use at the principal repair point where the wheel shop is located

per eight-hour day. The base unit of this wheel shop will be a building 80 ft. wide by 187 ft. long.

The shop equipment will consist of one 600-ton stripping press, two 300-ton mounting presses, one to be used in case of emergency, 7 axle lathes, 2 burnishing machines, 4 wheel-boring machines, 1 Magnaflex machine equipped with portable attachments for use in magnafluxing cut journals, 1 journal-turning lathe, one wheel lathe and additional grinders for sharpening tools.

The shop will also be equipped with an overhead monorail system throughout the building and will extend 200 ft. outside the building directly over the axle-storage platform. This unit will consist of eight electrically-operated hoists having a capacity of 1000 lb. each. Additional handling devices will include one or more gas-electric forked lift-trucks with which to handle

loose wheels and one three-ton Mobile crane for loading and unloading mounted wheels.

The storage space for second-hand and scrapped mounted wheels will consist of three double-spaced standard tracks, 400 ft. in length and will have a storage capacity of 1,200 pair of mounted wheels. These tracks will be accessible to the Mobile crane for unloading facilities. The wheels will be unloaded from the wheel car at the upper end of the aforementioned storage tracks which are gravity fed. The ends of these storage tracks will connect with the dismantling tracks through the means of an air-operated turn-table which will also have access to addi-



L. R. Topp,
Chairman

tional storage space to provide for the storing of wheels requiring machining of journals and wheels.

All scrap wheels received in the shop will be placed on a double-spaced standard track 120 ft. in length which will extend 60 feet inside of the building. This track will be accessible to all storage facilities and will connect directly to the car repair yard. The wheels and axles are inspected on this track to ascertain conditions of same, that is, as to whether they are to be considered secondhand or whether they are to be scrapped. This track leads directly to the stripping press where wheels are dismantled. The scrapped wheels go into an automatic lift that conveys them to a chute 200 ft. in length and equipped with 15 gates, thus making it possible to separate steel from cast iron wheels. This chute will be constructed in height just above the top level of cars which are of the gondola type making possible quick loading. The wheels will be loaded directly into the cars by opening the various gates, this being one of the greatest safety factors of a wheel shop as it eliminates the hazard of handling same by hand.

The disposal of axles will be handled by the overhead monorail system, whether they are to be placed for storage, scrapped or to be conveyed to the axle rack inside the building for turning. This rack will run adjacent to the axle lathe, burnishing machine and Magnaflux machine. The rack is 100 ft. in length and will consist of three tiers, the second and third tiers being gravity fed and running in opposite directions. The axles will be conveyed from either the storage pile or the stripping press by the use of the monorail system and will be placed on the top section

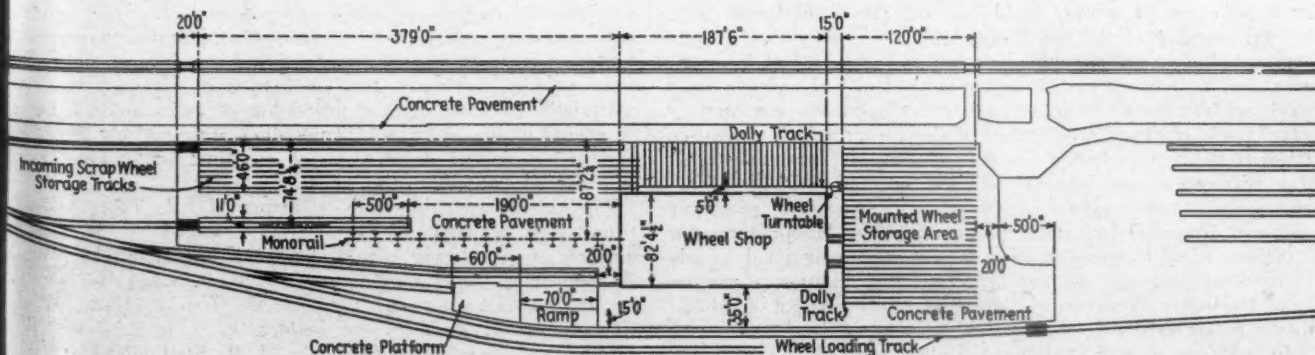
or tier in designated places, according to journal size, as a number of axle lathes will be in operation to cope with the various sizes depending on the wheel requirements. At this point the axles will be checked for bad centers. If centering is needed the axle will then be recentered with a portable recentering device. The axle will be placed in the axle lathe by means of an electric hoist.

All axle wheel seats will be turned to a predetermined size and this will be accomplished by either of two methods; first by use of dial-reading micrometers used the same as the old style side calipers on axle lathes not equipped with a turret tool post; and secondly by means of a fixed stop attached to the stationary portion of the carriage. This fixed stop will have a hardened steel block which will be adjustable to four positions each position being $\frac{1}{16}$ in. in dimension and increasing $\frac{1}{16}$ in. in each of the four positions. This fixed stop will work in conjunction with an adjustable vernier screw attached to the sliding portion of the carriage. This will facilitate the adjustments to compensate for tool wear and other miscellaneous adjustments. This method will be used on axle-turning lathes equipped with turret tool posts and permanent tool holders making it necessary to remove only the tool bits for sharpening. It is desired that all axle-turning lathes be equipped with live centers. The practice in effect is to turn all wheel seats, journals and end collars.

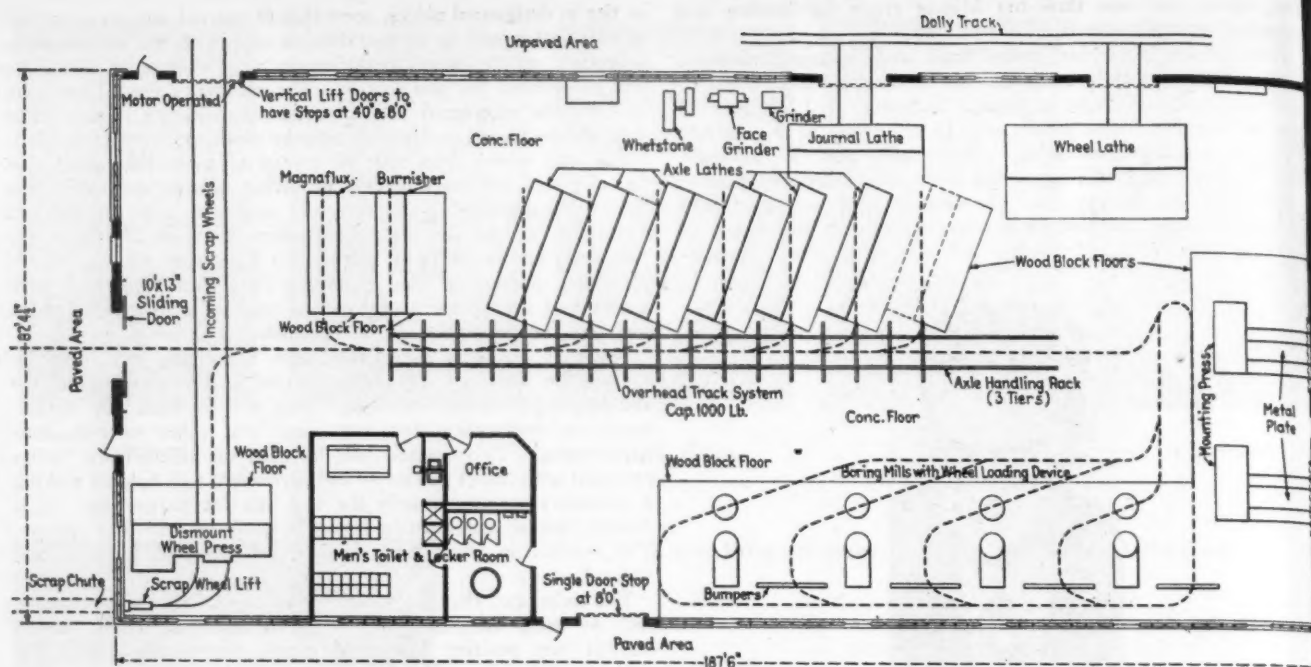
The axles can then be identified as to size by various means such as using various colors of paint, stenciling, chalk marks, etc., or any positive fool-proof means of identification. The axles at this point will be dropped through various openings in the top section of the axle rack to the second tier or layer of the rack which will automatically roll, this being brought about by the declined structure of the rack proper. At this time, the axle will then be picked up by the electric hoist mounted on the monorail and conveyed to the burnishing machine where the axle is burnished and then conveyed to the Magnaflux machine after which operation it is then placed in the third tier or bottom section of axle rack which is also gravity fed and extends 40 ft. beyond the 100-ft. length of rack, accommodating approximately 40 axles in line for the pressing on of wheels at the mounting press. However, before wheels are mounted at this 40 ft. section, the end collars are ground for any roughness or upset center holes preparatory to the final mounting of wheels.

The unloading platforms will be 35 ft. wide and 100 ft. in length, raised to car floor level having two tracks, one on each side with an additional stub track ending at one end. The tracks running adjacent to either side of this platform will facilitate the unloading of loose wheels that have been shipped in box cars; the stub-end track for wheels shipped in open end gondolas. The unloading of loose wheels shipped either in box cars or open end gondolas will be accomplished with the aid of gas-electric, forked lift-truck capable of handling six loose wheels at one time. The raised unloading platform will be connected by a ramp 75 feet in length and 15 ft. in width running directly to the wheel storage platform. The wheel storage platform will be constructed of pavement, 35 ft. in width and 200 ft. in length, running adjacent to the building being accessible to the building at the center and at both ends having a storage capacity of 5,000 wheels.

Wheels will be conveyed from the wheel-storage platform to the various boring mills by the use of the forked lift-truck, six wheels being delivered to each one of the boring mill stations. At this point of operation the wheel will be placed on the



General arrangement of the wheel shop and adjacent yard



Details of the facilities within the wheel-shop building

tilt-table and wheel-changing device which consists of two air-operated cylinders with a revolving cradle with two sets of jaws. The wheel is then raised to a horizontal position even with the boring mill table. This device is then operated in a manner which picks up both the finished wheel from the boring mill and also, in the same operation picks up the wheel to be bored from the raised table. The device is then turned around, depositing the wheel to be bored in the boring mill while the finished wheel is being placed on the raised horizontal platform and then lowered to the floor. The finished wheel will then be conveyed by the overhead monorail system to the axle rack for the assembly of wheels to axles.

In connection with the actual mounting of loose finished wheels on the finished axle, it has heretofore been mentioned that the finished axle now rests in the rack provided for it directly in line with the wheel-mounting press. At this location we have a stationary structural framework equipped with two manually-operated cantilever hoists, equipped with turnbuckles to accommodate the various sizes of wheels. The wheels having been delivered to this mounting press by means of the monorail system are then held in a vertical position through the use of the cantilever hoists and the journals of the axle to be mounted are then covered with protective shields to prevent damage to the journal proper. At this stage, the wheels and axle are brought into alignment by use of the turnbuckles the journals passed through the wheel hubs (one at a time) by slight pressure of the mounting press, protective collars removed, and the wheels pressed onto the axle.

All wheels after mounting are thoroughly checked and gaged preparatory to storage and that all gages are checked periodically with the master gage.

The storage of wheels ready for service will be accommodated on a series of 14 tracks, double spaced, 120 ft. in length with a total capacity of 940 pairs of wheels. These wheels will be segregated in accordance with journal lengths and wheel diameter, separated as between cast iron, one-wear steel and multiple wear steel and transported to the storage tracks by means of a narrow-gage track equipped with wheel dollies from which same are taken from the wheel shop and delivered to any respective track. The rear end or end farthest from the wheel shop of the aforementioned storage tracks is reinforced with a concrete pavement platform accessible by either life truck or the Mobile three-ton lift truck which compensates for the loading of mounted wheels in cars for shipment to outside points. In addition a narrow gage track has been installed for the transportation of wheels to the repair yard proper.

In addition to the facilities already described, consideration must be given to the turning of mounted wheels in the wheel lathe for existing defects such as slid flats, sharp flanges, tread-

worn hollow, built-up tread and high flanges. In this instance wheels are brought into the wheel shop by means of a narrow-gage track running adjacent to the building and directly into the lathe proper by means of a dolly at which time same are turned for their respective defects and then placed on the storage track for future handling.

In the handling of mounted wheels with defective journals it might well be brought out that the journal lathe is mounted on a depressed foundation to overcome the necessity of handling the wheels with either an air or electrical-operated hoist. In this respect, the lathe is so situated that the wheels can be rolled directly into position in the lathe without further handling.

In railway car wheel shops, like any industrial machine shop satisfactory operation and output are brought about only by constant vigil of supervision in the periodic checking of all gages and equipment. Gages are not only checked periodically against the master gage but, for recording devices used in the mounting and dismounting presses, additional gages are kept on hand to replace any which may become defective and thus prevent curtailment of production.

Discussion

Inasmuch as the report had to do with a description of the facilities and the methods in a proposed new wheel shop for one of the member roads the discussion was in the form of questions concerning details of the layout and equipment, most of which were answered by reference to the drawings displayed in the meeting room (these drawings are reproduced here—EDITOR).

Several members exhibited great interest in the use of carbide tools on the boring mills and axle lathes and one member said that with new boring mills, in his shop, there was no difficulty in obtaining more than 300 bored wheels before tool grinding was necessary and that these same boring mills were turning out from 75 to 80 wheels a day—either cast-iron or steel. The same member explained that production in his shop had been materially increased by the machining of axles and the boring of wheels in step sizes of 1/32 in., eliminating entirely the necessity for boring-mill operators losing any time for "miking" axles in order to match-bore the wheels.

The report was signed by Chairman L. R. Topp, assistant wheel shop foreman, C. & N. W., Chicago; A. M. Gusch, machine shop foreman, C. M. St. P. & P., Milwaukee, Wis.; F. Holsinger, wheel shop foreman, I. C., Chicago; G. Nirschl, general car inspector, A. T. & S. F., Topeka, Kan.; W. A. Emerson, general master car builder, E. J. & E., Joliet, Ill.; H. S. Marsh, general car inspector, M. P., St. Louis, Mo.; S. L. Sweet, mechanical inspector, N. Y., N. H. & H., New Haven, Conn.

Report of Committee on Loading Rules

The present A. A. R. loading rules need to be more generally understood, and the following comments should bring about a discussion that will be beneficial and educational.

Thorough knowledge of the A. A. R. loading rules is of the utmost importance if railroads are to continue to secure and handle this business satisfactorily. Those responsible for loading, handling and inspecting the loading of cars must have a thorough understanding of the rules to accomplish the desired purpose. The rules as written afford proper protection and it is not the lack of adequate rules, but rather the lack of understanding and compliance with the rules that is responsible for the troubles



T. S. Cheadle,
Chairman

experienced. The greatest success in securing compliance with the loading rules will result from handling by a competent person with the official of the companies loading the cars, as they usually appreciate the benefits resulting to themselves when shipments are properly loaded and arrive at destination in good condition and without delay, which would not result where shipments are improperly loaded and making it necessary to shop cars en route for transfer or adjustment of lading.

As a result of previous activities on the part of the Loading Rules Committee, there have been vast improvements in the more effective and honest endeavor to load cars properly and, when so loaded, loads disarranged from any cause are more easily adjusted, with reduced out-of-service time for cars and less damage to commodities.

Either sawed stakes or sapling stakes sawed to fit the stake pockets of flat cars properly are much better than stakes trimmed with an axe, for the reason that the dimensions of stakes are frequently reduced below minimum requirements when chopped

Problem of insuring a common understanding of the rules by all those responsible for their administration is emphasized

with an axe. It is recommended that the first sentence of Rule 10, Sec. C be revised to read, "stakes 4 in. by 5 in. must be tapered preferably by sawing to fit fully into and extend at least 4 in. below the stake pockets."

Lading on flat cars, or above the sides of gondolas, though properly loaded, cannot be secured so that it will always withstand shifting in present day-train handling. Shifted lading invariably is the result of impact which often could be avoided if cars were placed on or near the head end of trains.

Shippers are often dissatisfied with cars furnished that are not in proper condition for loading. Cars with bulged ends, sides, bad floors and bad stake pockets and too short for lading, result in cars being shopped en route.

Shippers often complain on account of not being allowed to ship cars in the same manner as received, or load cars the same way as received. This is due to the lack of uniform inspection.

A good many railroads feel that circulating questionnaires on loading rules among inspectors has created an interest in and study of loading rules, thereby improving the compliance with them.

The difference in requirements of competing railroads is a source of dissatisfaction and is not permissible, and where such conditions exist the matter should be called to the attention of the secretary of the A. A. R. Mechanical Division.



Baled lumber secured by branded side stakes

Some railroads report lading shifted due to not being loaded according to A. A. R. loading rules without giving details or exact information. This information is necessary in order to handle properly with those responsible for improper loading.

Discussion

Following the presentation of this committee report, Chairman Cheadle showed on a screen numerous pictures of special unit-banded lumber loads of all lengths, secured on open-top cars with side stakes and shipped from government forwarding yards for military use. Over 5,000 of these loads moved safely with only five requiring further attention en route. He stated that the cost of this method of loading would hardly be justified except in war-time emergency requiring exceptional speed and minimum manual labor in loading and unloading cars.

The committee's recommendation for revision of Rule 10, Sec. C. to specify the use of 4-in. by 5-in. stakes, tapered pre-



Typical baled lumber load prepared for shipment at the government reconsignment yard, Richmond, Va.

ferably by sawing, was approved for submission to the A. A. R., but it was pointed out that much lumber, especially in the west and northwest, is loaded far from any saw.

In closing, Chairman Cheadle said that strict adherence to the A. A. R. loading rules would tie up the railroads under present loading conditions when one road will accept loads refused by another. One member asked what good the rules are and another said that teeth must be put in the rules. In this connection, it was moved that the originating line be made responsible for all expense of adjustment necessary to bring loads within the A. A. R. requirements. This motion was put, voted on and defeated.

The report was referred to the A. A. R. for consideration.

The report was signed by Chairman T. S. Cheadle, chief car inspector of the R. F. & P., Richmond, Va.; P. R. Adams, chief interchange inspector, P. & L. E., Youngstown, Ohio;

D. W. Akins, superintendent car department, T. & P., Dallas, Tex.; F. Cebulla, master car builder, G. N., St. Paul, Minn.; W. P. Elliott, general car foreman, Terminal Railroad Association of St. Louis, East St. Louis, Ill.; W. A. Emerson, general master car builder, E. J. & E., Joliet, Ill.; G. L. Foster, joint supervisor car inspectors, all Lines, Cleveland, Ohio; T. E. Hart, chief car inspector, N. Y., C. & St. L., Cleveland, Ohio; E. N. Myers, chief interchange inspector, Minnesota Transfer, St. Paul, Minn.; S. C. Montgomery, superintendent car shops, I. C., Memphis, Tenn.; F. A. Shoulty, assistant superintendent car department, C. M. St. P. & P., Milwaukee, Wis.; E. K. Talbott, assistant superintendent of interchange, Chicago Car Interchange Bureau, Chicago; J. P. Walsh, car foreman, N. Y., N. H. & H., Boston, Mass.; F. H. Stremmel, assistant to secretary, A. A. R., Mechanical Division, Chicago.

Painting Freight Cars

The committee submits the following recommended procedure in painting of new and old freight cars: All lap joints and all contact places shall be given one heavy coat of cement or approved material for this purpose, also inside center sills, inside of side stakes, stake pockets, inside of bolsters and all parts riveted to frames before riveting, center plates, all angle irons, all riveted lap joints and all concealed places for new, or heavy rebuilt cars.

Cleaning Preparatory to Painting

The committee recommends sand or steel grit blasting of all new steel sides, ends and doors, underframes of all types of steel freight cars before painting, also all old steel cars when



R. B. Batchelor,
Chairman

paint is in bad condition such as checking peeling or cars that have the paint burned by soda ash or other strong caustics or alkalis. Protection must be provided to prevent sand entering the journal boxes, retaining valves or brake cylinders. This can be done with canvas hoods.

All sand, grit and dust should be thoroughly removed before painting. Blasting is the most efficient and best way to prepare cars for paint. It removes mill scale, old paint and rust in a minimum of time. Where air pressure is not obtainable or insufficiently high, flame cleaning with acetylene-oxygen can be used. New steel can also be washed with solution, but our recommendations are to blast.

We recommend a modern sandblast building for this work equipped with adequate exhaust system, lights, and dust cleaners to clean sand before re-using. A sandblast building assures constant operation regardless of the weather. The blasting can be done in the open with portable machines, but, after blasting, steel rusts quickly with little moisture and often the cars have to be reblasted. This causes considerable delay and extra expense.

Other ways of preparing cars for painting are—sanding machines, washing, wire brushing, or cleaning with a rotary sander,

or wire brushes. This method is recommended for cars not sandblasted or where old paint is not removed.

Priming and Painting

The committee recommends all steel or wood cars receiving one coat of good approved primer which should be allowed over night or 8 to 12 hr. to dry before applying finishing coats.

Some paint companies have a 4-hr. primer they recommend, and tests indicate that this primer is holding up well. All cars should be primed as quickly as possible after they have been sandblasted.

After wood or steel cars are primed, steel sides should be sandpapered if necessary and two coats of good approved paint applied in a workmanlike manner, so that work when finished will show a smooth even coating with good adhesion to the entire surface and be free of sags and dirt.

Drying time between coats is subject to the type of paint, and the manufacturer's recommendations. Paint should be applied by spray. After the last or second coat of paint has been applied and sufficient time allowed to dry, the cars should be stencilled with a good grade of stencil paste. The committee recommends over-night drying before stencilling.

We recommend first day, prime; second day, two coats of paint; and the third day, stencil. This means only two days time for painting, as a car can be weighed and shipped the same day it is stencilled, or the third day.

The above recommendations are for cars painted with quick-dry sulphonated oil paint or synthetic enamel paints.

Stirring or Agitating Paint

All protective coatings which are furnished in a ready-for-application consistency should be thoroughly stirred to an even consistency and so kept until it is used.

All protective coatings when thoroughly stirred must have a consistency with a room temperature of not less than 60 deg. F. that will make it satisfactory for spraying. If possible, a mechanical agitator should be used for agitating paint. Tanks of 168 gal. capacity with electric motors are satisfactory. These tanks will hold three barrels, and they mix or agitate paint quickly. The agitators are suitable for mixing paste pigments and oil. Several railroad companies are still using this type of paint.

These agitators give paint a uniform consistency more quickly and maintain it in this condition better than hand mixing or stirring. Paint in barrels can be emptied into these mixers with chain hoist or tram. Car cements and other types of cement paint can also be agitated in these agitators to a good advantage.

Portable air-operated pumps are available equipped with spraying apparatus and agitators. This is the latest modern equipment and more economical to use than separate agitators and spray equipment.

Kind of Paints

The committee recommends using quick-dry or sulphonated oil paints for all finish coats of paint on all freight equipment. Synthetic paints, if applied to cars inside of heated buildings in winter or bad weather or applied in warm weather to steel cars, have proved very good but do not hold up so well on wooden cars.

Paint made from oxide paste, linseed oil and paint oil produces a durable coat, but dries slowly and only one coat a day should be applied.

Also paste and oil requires an extra day to paint cars, or four days instead of three.

It is almost impossible to maintain any kind of schedule with this type of paint in cool weather where painting is done in the open. It is possible in the near future that paint manufacturers will develop paint far superior to the paints we are now using.

Proper protection should be provided for inclement or winter painting which will prolong the service life of the paint and effect maintenance economics.

Car Cement

We recommend that all underframes be sprayed with heavy car cement, also center sills, slope sheets of hopper cars, hopper doors, all side braces inside and inside plate rail, and inside ends of all box cars before siding is applied.

Black car cement should be of approved quality. It should not be thinned or heated above 100 deg. F. and must contain a minimum of not less than 10 per cent of fixed saponifiable and oxidizable oils properly combined with the base. It must not sag when applied with a cement spray gun. The material should cover about 50 sq. ft. per gal.

The committee recommends, after cleaning new galvanized roofs for new or rebuilt cars, spraying the roofs with car cement, also filling roof copings with the same material before they are fitted and riveted. Emulsified cement has given unusually satisfactory results on some railroads. This method assures a 100 per cent leak-proof roof. Galvanized running boards should be sprayed with the same type of cement as is applied to galvanized roofs.

Wood running boards should be made of rough unfinished lumber and receive only one thin coat of paint. Black-iron roofs, after being properly cleaned, should be primed and coated with a heavy coat of car cement.

Stencilling

The committee recommends spraying all stencilling. If the proper spray gun, cup and regulator are used, set the air-line regulator at 30 lb. and the gauge on the gun at about 10 lb. Heavy lead can be sprayed with little fogging and with proper stencil ties a good job can be done in less time than when applied by hand. The stencilling is more uniform.

Stencils can be made of red rope stencil paper, and by the use of $\frac{3}{16}$ -in. copper tubular rivets with No. 22 armature-wire soldered to the rivets where ties are needed. This leaves about $\frac{1}{8}$ in. bridge above the surface, eliminating any ties from showing where the stencil lead is applied either with a spray or by hand. Electric solder iron and acid core wire solder are most suitable for soldering.

Stencilling should be done with pure white lead, or a better paste can be made with the addition of 10 per cent zinc ground in oil.

Several paint manufacturers are furnishing white stencil paste which is showing up well. The addition of zinc to lead stops chalking to a large extent.

Painting of Steel Sides Inside

In assembling sides of steel box cars, all laps and joints shall be given one coat of heavy sealer or cement. After assembling, sandblasting and priming exteriors are completed the entire inside surface should be sprayed with one heavy coat of car cement, emulsified cement or insulating material. When insulating material

is not used, sawdust can be blown on the ceiling while still wet. This helps eliminate some condensation in hot loaded cars.

After floors are laid, the space between ends of flooring and steel bottom angle sides and ends should be filled with heavy cement before the lining is applied, after the inside of the lining has been applied and the car has been painted. The floor should be sanded and receive one heavy coat of approved floor sealer.

The top surface of side plates should receive one solid coat of heavy black car cement before a new roof is applied. Exterior ends of cars should be painted the same as sides—sandblasted, primed and two coats of approved paint. Several railroads apply heavy cement to car ends.

Brake cylinders, valves and reservoirs to be painted with one spraycoat of approved paint the same as used on the body. Trucks are to be painted one very light thin coat of body paint.

Several acid and alkali-resisting paints are on the market and several of these paints appear to be holding up well, but we cannot make any definite recommendations at this time.

In the future, plywoods will be used to a larger extent than ever before. The committee recommends the all plywood be given a proper coating or rosin sealer on surfaces and edges before installation to the car. This is essential to help keep out moisture.

Painting Refrigerator Cars

Cleaning—All surfaces must be thoroughly cleaned, free of rust, scale, dirt, grease and moisture before painting.

If facilities are available, the steel work should be sand or shot-blasted in the following locations: (a) the entire outside of the car, including sides and ends, but excluding roofs if they are galvanized; (b) the entire underframe; (c) side and end sills inside; (d) inside of side and ends approximately 18 in. up from the sills.

If sand blasting is not available, a good job of cleaning with wire brush and a petroleum solvent or commercial metal cleaner will be acceptable.

Materials—All paints and cements must be of makes specified by the individual railroads but the best quality materials available on the market are recommended.

Joints—Roofs: car cement. Sides and ends: red lead joint paint or approved lap and joint primer. Underframe: car cement.

Concealed Surfaces—All concealed surfaces not accessible after assembling should be given one heavy coat of car cement before assembling.

Underframe—First coat: chromate or fast-drying red-lead primer. Second coat: heavy application of car cement or asphalt emulsion.

Sides, Ends and Doors—Inside—First coat: chromate primer or fast drying red lead priming paint. Second coat: Dednox or Railway Insulmat No. 595, $\frac{3}{8}$ in. thick.

Ends—Outside—First coat: chromate primer or fast-drying red-lead primer. Second coat: heavy application of asphalt emulsion or car cement.

Sides and Ends—Outside—First coat: chromate priming paint or fast-drying red-lead priming paint. Second and third coats: synthetic refrigerator car enamel.

Roof—Outside—If galvanized, one heavy coat of car cement with dark red slat granules.

If black steel, that is, not galvanized, the steel work should be given a coat of chromate primer or fast-drying red-lead primer before application of the car cement.

Roof—Inside—If galvanized, the roof is not to be painted.

If black steel, the roof should be given a heavy coat of car cement on the inside.

Trucks, Brake Rigging and Safety Appliances—One light coat of light-body fast-drying black paint.

Running Boards—Galvanized metal running boards should be given one coat of black paint or cement of a quality suitable for galvanized surfaces.

Wood Framing—Before installing the wood framing it should be given one coat of wood sealer of clear Spar varnish.

Hatch Plugs—The inside of the hatch plugs should be given one coat of chromate primer. The outside of the plugs to be given one coat of chromate primer followed by a heavy coat of asphalt paint and, before the paint is dried, spray it with red slat granules. A strip wide enough for the stencilling on the outside of the cover should be shielded and then given two coats of fast-drying black paint.

Bottom Floor—Before applying to the car, the bottom flooring should be given one coat all over of mineral brown paint or sealer.

Doors—All of the door stiles that are covered with zinc or galvanized should be given one coat of mineral brown paint. The exposed surfaces of the door stiles will receive one coat of clear spar varnish.

Plywood Lining and Ceiling—All plywood lining and ceiling material used inside of the car should receive one coat of resin sealer, preferably applied at the plywood mills.

After this material is in the car, the entire surfaces inside of the car should receive two coats of clear spar varnish.

Floor Racks—One coat of clear spar varnish.

Sub-Lining—If the refrigerator car is equipped with a circulation space along the side walls, the face of the sub-lining toward the circulation space to be given a coat of car cement. The inside face of the side lining proper toward the circulating space is not to be painted.

Stencilling—All stencilling on the outside of the car to be sprayed on. It will be satisfactory to pounce the stencilling on the inside of the car.

We recommend that next year's committee be extended to include the many other branches of Railroad painting and terminal upkeep as well as improving on our present recommendation.

Discussion

In connection with the treatment of box-car floors, the statement was made that approved floor sealers are satisfactory for covering oil or grease spots, but there is no floor protective coat-

ing which will harden the surface of floor boards and prevent water damage, peeling and slivering. Apparently a reliable coating of this type is needed and would effect substantial savings.

One member said that the only coating which will stay on galvanized iron is an emulsified cement which has the necessary adhesive properties and will remain flexible and pliable. The committee, however, was not in a position to make a specific recommendation.

There was considerable discussion in favor of spray stencilling and different methods of making stencils. One member referred to the increased labor and cost of making hand-cut stencils, with hollow copper rivets and piano wire ties and said that a throw-away paper stencil, machine-cut in quantities and discarded on excessive accumulation of stencil paste, would be economical and also save the labor of cleaning.

Asked about the painting of freight-car trucks, Chairman Batchelor said that some paint will naturally get on the trucks while painting car bodies and a light coat on the trucks to complete the job will improve the appearance and should not be objectionable.

The report was signed by R. B. Batchelor, paint foreman, Wabash, Decatur, Ill.; H. E. Kneeder, painter foreman, C. & E. I., Danville, Ill.; D. A. Reavis, general foreman, car department, N. C. & St. L., Nashville, Tenn.; Rex Middleton, painter foreman, Nickel Plate, Chicago; L. L. Pierce, General American Transportation Corporation, East Chicago, Ind.; R. M. Shaver, mechanical engineer, Pullman-Standard Car Manufacturing Co., Michigan City, Ind.; H. C. Griffin, service engineer, Milard & Co., Chicago, Ill.

Interchange and Billing for Car Repairs

Since the last convention in 1941, your committee has continued to function and has prepared reports which have been submitted to the Association of American Railroads for clarification of and changes in current interchange rules. A number of these recommendations have been accepted by the A. A. R. and, it is hoped, have resulted in facilitating the interchange of cars and a reduction in correspondence in connection with billing for car repairs.

Several rulings have been given by the Arbitration and Price Committees of the Association of American Railroads to indi-

Many changes proposed for clarification of the rules—Complete rewriting of Rule 44 is included

that new brake beams must be painted. Your committee is of the opinion that there is no necessity, from an operating or maintenance standpoint, that new brake beams should be painted. Therefore, in view of the increased cost of this service and to expedite deliveries, your committee recommends that Item 13(b), Page 81, Sec. E, of the A. A. R. Manual of Standard and Recommended Practice be revised so as to make this requirement optional.

Last year your committee was requested to submit a revised form of A. A. R. Rule 70. As we had information that a revision of this rule would be made by the Arbitration Committee and would probably be incorporated in the 1946 Code, it was decided to carry this matter on our docket for further consideration. Unfortunately, we have been unable to complete our survey in time to submit a revised form at this time; however, it is hoped that a revision can be developed and included in next year's report.

It is the thought of your committee that the allowances covering wheel changes, as specified in Items 266-276 of Rule 107 and Items 21-24 of P. C. Rule 21, do not compensate the repairing line, particularly so since the rules governing wheel-shop practices, as defined in Sec. 20 of the Wheel and Axle Manual, were modified making mandatory certain wheel-shop requirements. We, therefore, recommend that the A. A. R. conduct a study of wheel-shop costs, including application of wheels to cars and revise the present allowances accordingly.

It is further recommended that the A. A. R. give consideration for including in the rules labor allowances for repairs to automobile-loading devices in cars.

Your committee is not certain that their activities include a survey of the Wheel and Axle Manual; however, a recommendation has been received which, we believe, is worthy of consideration. It is recommended that the first sentence of Par. 28-A, Page 26 be revised to eliminate the words "multiple wear" as the table of symbols covers all types of wrought-steel wheels.



C. A. Erickson,
Chairman

vidual members in reply to questions raised with respect to the intent of various rules pertaining to the interchange of and billing for repairs to cars. We believe that, if all members were furnished with this information, it would avoid controversies and reduce correspondence and, therefore, recommend that such rulings be included in the annual report of these committees and that this recommendation be submitted to the A. A. R. for consideration.

Our attention has been directed to the fact that some delays are being experienced in the delivery of brake beams from manufacturers owing to the A. A. R. standard requirement

Index

At the last convention, a recommendation was approved to submit an offer by your committee to the A. A. R. to undertake a revision of the index to the Freight Car Code of Interchange Rules. This offer was accepted and the revision, as finally approved, is now in the book of rules. It has been suggested that it would be an advantage to have a compact index of the principal features of the passenger car rules and this could, we believe, be embodied in approximately 50 items. In view of the amount of work which would be involved in compiling such an index, we recommend that an offer be made to the A. A. R. that your committee undertake the preliminary work of preparing the index. If such offer is accepted, we will proceed with the work and, if sufficient time is available, complete it before our next convention.

Your committee recommends that changes, as shown in the table, be made in the present index.

Last year your committee recommended that the requirement to show various axle dimensions on billing repair cards be

Recommended Changes in Present Freight-Car Rule Index

Item	Recommendation
Air brakes A.B. experimental	Delete, account now eliminated from Rule 60
Abbreviations, use of	Add Rule 56
Air brakes, information required on billing repair card	Add Rule 101
Air hose, new or spliced per A.A.R. specifications to be used	Change to read: "Airhose, new, to be used"
(Blank)	Add new item: "Axle, tubular, use of, . . . 86 PC7" (to follow present last item under A).
Billing for car repairs, reference to regulations governing	Add Rule 124
Bills for repairs on authority of defect card	Add Rule 8
Bills for temporary repairs at car owner's expense	Add Rules 112 and 120
Brake beam, identification table	Change to read: "Brake beams, identification of"
Card, defect	Add Rule 8
Cars damaged, responsibility	Change rules to read, 4, 32, 33, 41-45
Changes in 1943 rules	Change to read: "Changes in rules from previous issue"
Damage to cars, general, responsibility	Change rules to read: 4, 32, 33, 41-45
Defect card, use of	Add Rule 8
Improper repairs	Add Rule 101
Journal boxes, repacking of	Add Rule 124
Journal box lid, renewal	Add Rule 104
Material, substitution of	Add Rules 18, 26, 32, 33, 59-62, 66, 86, 95, 101, 108, 112
Refrigerator cars, requirements in interchange	The word "requirements" should read "Requirements"
Repacking of journal boxes	Add Rule 124
Repair, improper	Add Rule 101
Responsibility for cars damaged, general	Change rules to read: 4, 32, 33, 41-45
Temporary repairs at car owner's expense	Add Rules 112 and 120
Trucks, interchange requirements	Delete account already covered by second item above same
Underframe damage, responsibility	Add Rule 45

eliminated. This recommendation has not yet been adopted by the A. A. R. and, possibly, we should have furnished more detail regarding the manner in which the car owner could be assured of proper charges and credits being made for axles applied and removed.

While some railroads use their wheel-shop records exclusively as a basis for recording wheel and axle details, a number of roads still rely on records taken at the repair point. Consequently, insofar as the latter railroads are concerned, it is our thought that simple "No Go" gages could be designed to insure that axles could be properly classified as second-hand or scrap as regards journal, wheel-seat and axle-center diameter. Additional "No Go" gages could be designed for checking oversize wheel seats. The present journal length and collar-limit gages would be used for checking journal length and collar dimensions.

The use of such gages would enable present dimensions details on billing repair cards to be eliminated; however, special checks would be necessary to insure that gages were not being used which were worn to the extent that axles were being condemned when still O. K. for service. In the event an axle was scrapped, billing repair card would show the reason for scrapping the axle. Some reference to wheel-seat diameter may be necessary in connection with axles applied in order to insure proper charges for wheels mounted on oversize wheel seats.

It is recommended that a further submission be made to the A. A. R., as outlined above, as the recording of actual dimensions

under the present Rule requires a considerable amount of time which could be reduced substantially if our suggestion receives favorable consideration.

Rule 44

Your committee is aware of the number of activities initiated with a view of simplifying this rule so that it will be understood by all concerned and responsibility for cars damaged to the extent as outlined in the rule properly assessed. In view of the superfluous wording, complicated notes and, in our opinion, some impractical requirements, it is our thought that the rule should be completely revised; therefore, we have prepared a proposed rule and recommend that it be referred to the A. A. R. for consideration.

Rule 44—Proposed Form

When a car is damaged to the extent shown below, if same occurred in ordinary handling, a statement must be furnished showing the circumstances under which the damage occurred in order to establish responsibility of car owner for the repairs. This statement, in the case of cars reported under Rule 120, to accompany request for disposition of car, and, in cases where it is not necessary to report car under Rule 120, to accompany the bill for repairs.

Handling line must attach information or defect card to car for the following defects, as provided for in Rule 4:

(1) All-steel underframe cars having two or more longitudinal sills—both abruptly bent, vertically or horizontally, in excess of $2\frac{1}{2}$ in., within a space of 6 ft. between rear edges of body bolsters, regardless of whether or not one or both are wholly or partially broken.

The car owner is responsible for downward sagging of sills, including buckling in excess of $2\frac{1}{2}$ in. brought about thereby, also, for damage to center sills without cover plate top or bottom extending from bolster to bolster.

Car owner is responsible when damage to the steel center sills is confined within the space from end sill to rear face of body bolster.

When buckling of center sills, as above described, is due to corrosion, joint inspection certificate, so indicating, signed by joint inspector or by two inspectors, one of whom must represent a disinterested railroad, shall constitute sufficient evidence that damage occurred in ordinary handling.

Steel draft members extending from end sill to end sill and used to reinforce wooden center sills are not longitudinal sills.

(2) Steel tanks of tank cars where secured by bolsters or center anchorage, if shifted account of all anchor rivets being sheared off.

Car owner is responsible for the shifting of or damage to tank when:

(a) Tank is secured to sills with bolts; (b) center sill rivet holes are elongated; (c) cars are equipped with cradle casting center anchorage.

(3) Saddle sheared from tank, or tank sheet buckled between saddle castings, or damage to both draft members on same end of car, on tank cars without center sills.

Interpretation. (1) Q.—Is a brief statement that car was not damaged under any condition prescribed in Rule 32 sufficient to establish the responsibility of car owner?

A.—No. Except as otherwise provided, statement must show details of the circumstances under which the damage occurred so that owner may know how responsibility was determined.

(2) Q.—In connection with first paragraph, in addition to showing the circumstances under which the damage occurred, when reporting a car for disposition under Rule 120, if subject to Rule 44, is it necessary to state briefly whether the car was subject to any of the unfair conditions of Rule 32?

A. Yes.

Rule 45

In the event suggestion to revise Rule 44, as recommended, is accepted, it will be necessary to revise Rule 45, as follows:

Proposed Form: All-steel underframe cars shall not be accepted from owners with one or both metal center sills abruptly bent between body bolsters when deflection is in excess of $1\frac{1}{2}$ in., unless defect card of car owner is attached to car. Such defect card is an acknowledgment of responsibility for any additional deflection due to further bending of the sills. Handling line,

however, will be responsible for such bent sills if subsequently broken under the provisions of Rule 32.

Rule 64

The committee recommends addition of the following to the second paragraph:

Proposed Form: No charge shall be made for application of separate common nuts unless such nuts are fully tightened, and, where applied to journal-box bolts, column bolts, brake-hanger bolts, carrier-iron bolts, or coupler and draft-gear support bolts, such common nuts must be secured with nut lock or lock nut. *Unit nuts may be substituted for common, grip or lock nuts.*

Reason: Rules 101 and 107 provide material charge for such nuts and we believe it would be an advantage if Rule 64 authorizes their use in replacement.

Rule 65

The committee recommends that Rule 65 be revised, as follows:

Proposed Form: Missing journal bearings and (or) journal wedges; journal bearings (regardless of previous condition), journal wedges, journal-box bolts and dust guards which require renewal, when delivering company is responsible for change in wheels and axles.

Reason: it is believed owner should not be responsible for missing journal wedges. If this recommendation is not approved, the item "Journal wedge, missing, responsibility" should be deleted from the Index of the Interchange Rules.

Rule 9

The committee recommends adding the following in bracket covering wheels and axles R&R.

Proposed Form: *When other than cast-iron wheels are removed or applied, show how car is stenciled.*

Reason: To facilitate proper charges in accordance with Rules 70 and 98.

Rule 10—Second Paragraph

Proposed Form: In all cases of multiple-wear wrought-steel wheels the amount of service metal in the tread must be shown before and after turning, measured from the center of the tread to the condemning line which is located $\frac{3}{4}$ in. above the measuring point; also show amount of service metal on other wheels applied, based on full flange and tread contour; *such measurements to be taken by the A. A. R. Standard Wheel Gage or approved equivalent.* It must also be stated whether such wheels have standard full flange and tread contour. This information must be reported to car owners regardless of whether or not repairs are chargeable to owners. For one-wear wrought-steel wheels, see Section (i) of Rule 98.

Reason: To conform to Rule 98 (d) (e) and (f).

Rule 70

The revision of Rule 70 Sec. (c), effective August 1, does not provide that charge should be made for new one-wear wrought-steel wheels or maximum permissible charge for 1-WT wheels when such wheels are applied in place of multiple wear or second-hand wrought-steel wheels standard to car on account of handling-line defects. We, therefore, recommend the following addition:

Proposed Form: *When handling line is responsible charge for new 1-W, or 1-WT, wrought-steel wheels must not exceed secondhand value of 1-W wheels.*

Rule 98

It is recommended that Sec. (b) 1 and (b) 3 of Rule 98 be revised, as follows:

Proposed Form: (b) 1. If new wheels or new axles are substituted for second-hand wheels or second-hand axles, no charge shall be made against car owner for difference in value of such when repairs are made account delivering company's defect, except as provided in paragraph 5 or when betterments are applied to cars stenciled "NEW STD" as outlined in the fourth paragraph of Rule 16.

(b) 3. Where one or both wheels are slid flat and axle is condemned account owner's defect, the charge against car owner shall be confined to the net value of the axle, except when

betterments are applied to cars stenciled "NEW STD" as outlined in the fourth paragraph of Rule 16.

Reason: We believe it is the intent of the rule that the car owner should accept full material charge for betterment in such cases. Some owners are objecting to the betterment charge when such parts are applied in connection with delivering-line defects.

Rule 98—Section (i)

In view of the fact that the present method of crediting and charging for other than new or second-hand one-wear wrought-steel wheels, as provided for in Sec. (i), was an emergency measure, your committee recommends that the present method of calculating the value of such wheels be deleted and the former method of classifying such wheels as a second-hand or scrap (determined by service condemning or remount gage limits) be reinstated.

Reason: The present method results in considerable amount of recording and detailed checking at wheel shops and creates considerable delay in the rendering of bills where such wheels are involved.

Rule 101

Your committee recommends that Cardwell M-type $7\frac{1}{16}$ -in. by $10\frac{1}{16}$ -in. draft springs be included in table showing weight of draft springs. Our information is that these springs weigh approximately as follows: Outside coil, $46\frac{1}{2}$ lb.; inside coil, $17\frac{1}{2}$ lb.; total, 64 lb.

Rule 107

Item 4: Belt rail or belt-rail blocks, R&R or R, per linear foot \$0.25

Item 161: Sheathing, side or end, renewed in connection with renewal of sill, plate or belt rail; reduce renewal price of sheathing per foot board measure for each sill, plate or belt rail renewed \$0.02
No deduction to be made when side plate, sill or belt rail is spliced

In view of the fact that some cars have three belt rails (which would result in labor charge for renewing sheathing being a net credit when all belt rails, side sills, and top plates were renewed at the same time), your committee recommends that the A. A. R. Price Committee review Item 161 with a view of arriving at a proper reduction in Items 159 and 160 when only side sills and top plates are renewed, and make such adjustment in allowances for belt rail in Item 4 as this may necessitate.

Item 36: Carline, wood, radial type, renewed, exclusive of all related work; includes renewal of bolts or lags through side plates and anchor bolts only, per carline 14

Item 113: Paper, insulation, or hairfelt, cork, etc., on refrigerator cars, actual time to be charged except when renewed in connection with posts, sills, plates or carlines

There appears to be a conflict between these two items inasmuch as Item 36 provides a labor allowance for carlines, whereas, Item 113 prohibits additional charge for material specified when R&R in connection with such carlines. It is recommended that the A. A. R. Price Committee give consideration to the question of whether or not carlines should be included in Item 113.

Item 116: The committee recommends revising Item 116, as follows:

Proposed Form: Placards, or advertisements, temporary, removing, reversing, or application, on authority of defect card, per car 0.3

Reason: To clarify the intent of the rule, this charge is permissible only on authority of defect card.

Item 291: Your committee recommends that Item 291 of this rule be changed, as follows:

Proposed Form: First rivet on car other than when specified allowance is already covered in this rule, any size, applied, net

Reason: Objections are being taken to charge per Item 291 for a rivet which is not the first rivet recorded on the repair card, such as, ladder iron rivets (where charge is confined to the cost of ladder complete) and rivets per Items 42 and 53, when such rivets happen to be the first rivet to be recorded. We are of the opinion that the intent of Item 291 is that the first rivet covered by Item 292 is the rivet for which allowance per Item 291 should be charged.

Rule 107

The committee recommends that, in the case of parts which might be either wood or metal, where the item specifically refers to wood parts the word "wood" be specified.

Reason: It is believed that, in a number of cases, the labor allowance applies only to the R&R of wood parts.

Discussion

In the absence of Chairman Erickson, owing to illness, this report was presented by Vice-Chairman Bell. The recommendation in the sixth paragraph for the A. A. R. to consider specifying labor allowances for repairs to automobile-loading devices was suggested by the committee with a view to reducing the present large amount of correspondence with the manufacturer. Discussion from the floor indicated that the complications of this device and frequent changes in design would make it difficult to establish suitable prices. The recommendation was ordered tabled.

In the second paragraph under Rule 9, the additional gages referred to are "Go" gages and the word "No" should be eliminated. It was also pointed out that, in the following para-

graph, the special checks referred to are the "periodic" checks.

In Rule 70, first paragraph, the words "one-wear" were ordered inserted after "second hand" near the end of the first sentence.

With the exception of the action noted, all other recommendations of the committee were approved and the report referred to the A. A. R. Arbitration Committee.

The report was signed by Chairman C. A. Erickson, general A. A. R. inspector, C. & N. W., Chicago; Vice-Chairman D. E. Bell, A. A. R. instructor, Canadian National, Winnipeg, Man.; M. E. Fitzgerald, master car builder, C. & E. I., Danville, Ill.; R. W. Hollon, mechanical inspector, C. B. & Q., Chicago; L. J. Larrisey, chief A. A. R. inspector, Erie, Cleveland, Ohio; J. J. Sheehan, supervisor car repair bills, M. P., St. Louis, Mo.; C. R. Weigmann, chief interchange inspector, St. Louis, Mo.; F. Peronto, assistant to secretary, A. A. R. mechanical division, Chicago; C. W. Kimball, assistant supervisor car inspector, Southern, Atlanta, Ga.; H. C. Argast, superintendent, St. Louis Refrigerator Car Company, St. Louis, Mo.; F. McElroy, assistant to vice-president, Union Tank Car Company, Chicago; W. J. Burns, mechanical inspector, General American Transportation Corporation, Chicago.

Report on Light Car-Repair Tracks

With the advent of modern freight cars of all types and longer life between shopping dates for general repairs, a greater portion of freight car repairs are made on light repair tracks. While light repair tracks will vary greatly in size, location, etc., according to the requirements of the service, there are certain fundamental requirements which will apply to all light-repair tracks. While some of the suggestions made in this report apply particularly to new proposed light-repair tracks, other recommendations would apply equally as well to those already in use.

Location

The first step, and perhaps the most important in building a repair track, is the location. Too often in the past light repairs were located on tracks which were already available without



B. J. Huff,
Chairman

consideration to availability or economy and efficiency of operation. The question of location should not be decided by the transportation department, or the engineering department alone. Neither should it be selected by the car department alone. All three departments should be consulted and each given an opportunity to express its views and support them with facts. Locations selected entirely by the transportation department obviously disclose a reason, the reason usually being less switching. Those selected by the engineering department in conjunction with the transportation department usually reveal that the major consideration was given to initial cost of construction. No thought is given to cost of operation which invariably is increased beyond

Discussion of location and arrangement of tracks; kind and quantity of special facilities and tools needed—Automotive equipment grows in importance

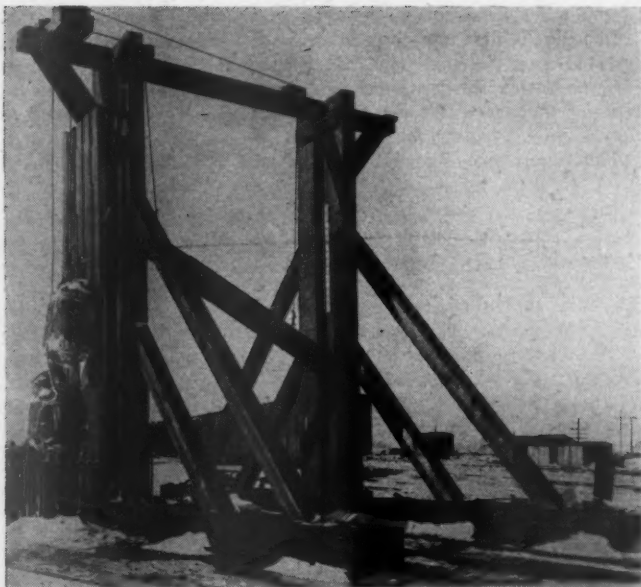
expectation. It is therefore, of primary importance that all three departments be consulted with reference to plans for location and construction of or changes in light-repair tracks.

Repair tracks should be located at terminals which will permit the prompt repair to system empty cars with minimum back haul. Light repair tracks should be located adjacent to classification yards and should be directly connected with switching leads on both ends of yards, regardless of switching practices. Repair tracks should also be provided with roadway entrance to permit private automobiles, company-owned highway trucks, ambulances, fire-department trucks and pedestrians to reach the repair track directly from the street or public highway without the necessity of crossing tracks. This provides much better fire protection, permits quick response to ambulance calls and eliminates crossing tracks being switched. It also permits the handling of road repair work promptly, eliminating the delay and expense of loading cars and switching road material to a point accessible to highway truck.

Layout

The layout of light repair tracks depends largely on the plan of operation. Most repair tracks are operated using the method of spotting the cars for repairs over the entire yard and moving the men, tools and material to each car repaired. A few roads are using the spot system of repairs, moving the cars through certain spots for repairs and segregating cars which require wheels, and other truck repairs which require jacking of cars, to one track where permanent jacking pads, air jacks, crane for handling Bettendorf trucks, for dismantling and assembling trucks and other special equipment are installed. This type of repair track offers several inducements in its favor.

In the first place, the size of this type of repair track can usually be reduced. By the use of permanent jacking pads, air jacks, jib cranes, equipped with air or electric hoists for handling truck sides and bolsters, wheel storage located adjacent to wheel spot and all other special tools and equipment required for changing wheels and other truck work, the time for changing wheels can be reduced from 50 per cent to 60 per cent. Tests on one railroad show that wheels are applied with this type of equipment in from 20 min. to 35 min. with an average time



Fixed load-shifting device against which cars are pushed—Counter-weighted cross-beam is air operated

required of less than 30 min. per car, or approximately two man-hours per car. The average time required, including delivery of wheels to the car and all other work, is approximately 4 man-hours per car.

The spot system of light repairs permits the storage of material close to the place where it is used and eliminates the unavoidable delays in many cases of waiting for material. It also reduces materially the time required for handling tools and equipment to cars and also time required for men to move from one car to another. This also permits the use of specially assigned gangs to various types of work such as truck work, steel-fitting gang, riveting gangs, wood work, etc. While there would be approximately two to five minutes lost time per car for moving cars, we believe this would greatly reduce the lost time over the present method and give the men better direct supervision.

We are submitting as an ideal spot system repair track layout a yard consisting of four tracks, all connected with switching leads at both ends of the yards. One track will be used for unloading and loading material and scrap, two tracks equipped with necessary permanent installations, including car remover for spot system of repairs, and one track on the opposite side for dead work. The two tracks for spot repairs should hold approximately thirty cars ahead of the repair spots and provide the same amount of room on the opposite end for repaired cars. The repair track would require switching twice a day. A dead track is provided to furnish work when all men cannot be used on the repair spots and also to take care of cars which cannot be repaired by the spot system. This track should take care of the objections of many that all light-repair cars cannot be repaired satisfactorily using the spot system. With two tracks for spot work having a total capacity of 30 to 35 cars and an additional dead track for other repairs with a capacity of 30 cars, a daily output of 60 to 75 cars should be handled very satisfactorily.

The spot system for light repairs can also be used on stub-end light-repair tracks by placing cars to be repaired on the rear end of tracks and locating repair spots in the middle of the yard. With this arrangement, however, work would be delayed if the repair tracks were pulled and other cars spotted during working hours, and it would probably be necessary to use men on repairs to cars on a dead track when cars were not available on tracks where the spot system is used.

Track Spacing

We would recommend repair-track centers from 24 ft. to 28 ft. so that ample space may be provided for roadways, material storage and movement of portable tools and equipment and automotive equipment.

Ballast should be of gravel, chat or stone, and should be applied to sufficient depth to make a good foundation for jacking cars and also to aid in the surface and subsurface drainage.

Roadways should be made preferably from concrete. In some climates, roadways made from asphalt, commonly known as black top, have proved satisfactory. Roadways in our opinion are preferable to service tracks because they permit traffic to move both ways at the same time without delays, permit better use of automotive equipment and facilitate the operation of all portable tools and equipment. Roadways which are constructed the full width of spacing between repair tracks can be constructed to take care of all surface drainage and can be equipped with manholes for sewer openings. Numerous crossings should be provided for convenient use when needed.

Repair tracks should be equipped with water lines and also sufficient fire hydrants to protect the buildings and yards in case of a fire. A track or spot on some repair track should be equipped for washing out cars.

Air lines on top of ground and located near the rail are much easier to maintain than those installed underground. All air lines should be equipped with expansion joints and water drain plugs.

Electric power should be provided for lights and power. Special subsurface lines are desirable on repair tracks for electric welding. Special lighting facilities, including stationary flood lights and plug-in sockets for portable flood lights and extension cords would be installed at locations where emergency work will be performed at night.

The location, size and layout of shop buildings should be given careful consideration. We recommend that shop buildings be located on one side of the repair track as near the center of the repair track as possible and adjacent to a roadway entrance from the public highway or street. All buildings which require heat and hot water should be built in one unit as far as possible to reduce the cost of construction, maintenance and operation. Sufficient room should be provided for a blacksmith shop, mill room, air-brake room, tool room, wash and locker room and toilet facilities. The buildings should be of fireproof construction.

Unloading platforms and material storage platforms should be provided adjacent to the track for unloading material as centrally located as possible. Material racks made from scrap steel such as rail, channels or boiler tubes make satisfactory material racks for storing such material as brake beams, spring plank and other similar material. A well-laid-out storage platform encourages the orderly storage of all kinds of material.

If space is available, a refuse dump from which refuse can be loaded up with a clam shell is desirable. This dump should also be equipped with a modern incinerator.

Equipment

A careful study of the equipment required for each repair track should be undertaken and every effort made to secure available modern equipment. A jib crane or monorail equipped with an air or electric-hoist provides a satisfactory method of unloading and loading wheels. These facilities should be located in connection with the wheel storage to reduce handling of mounted wheels to and from storage for loading and unloading to a minimum. The mounted wheel storage should be located directly opposite the wheel spot when the spot system of repairs is being used. When the wheels are delivered over the entire repair track it should be as centrally located as possible. Where an automotive crane is available it also helps in loading and unloading wheels.

Automotive cranes and lift trucks are economical for delivering wheels and other heavy material, handling material on skids, and also heavy scrap at points where repair tracks are large enough to justify their use. Light automotive equipment is desirable for delivery of material on larger repair tracks. Automotive cranes are also being used for the application of couplers and other heavy parts to cars and adjusting and shifting loads on cars. Hard-surface roadways are essential for most satisfactory use of automotive equipment.

Highway trucks are economical for use in handling material to various yards for emergency use, for emergency road repairs and also for derailments and wrecks when the steam derrick is not required. Derailments can be handled with a great saving in time over the old system of switching a tool car or derrick to the point of the accident. Where this service justifies its use, a highway truck equipped with jacks, blocks, cables and other necessary equipment is desirable; highway trucks should

be enclosed and at least two-ton capacity and should be equipped with a lifting device for handling wheels and other heavy material. Highway trucks of larger capacity equipped with a crane have also proved satisfactory for handling empty car bodies.

Drop tables should be provided on repair tracks which are handling wheel changes on passenger equipment where sufficient work is performed to justify them.

Air-operated jacks for jacking both loaded and empty cars will reduce the cost of this work over hand-operated jacks. It is estimated that a saving of 33⅓ per cent can be made on this work by the use of air jacks and many accidents will also be prevented when air jacks are used. Special hand-operated jacks of various types, including coupler jacks, hydraulic journal jacks and floor jacks, should be provided. Portable and stationary-end straighteners are necessary equipment for straightening all types of steel ends. Some roads have also installed special load-shifting devices. A combination woodworking saw is helpful at points where no other woodworking machinery is maintained.

Every light repair track should be equipped with some type of draft-gear and coupler lifts, special air or electric motors for raising and lowering auto loaders at points where required, oil-burning rivet heaters, A-frame devices for dismantling and assembling Bettendorf type trucks, portable acetylene cutting and welding outfits, special equipment for quick removal of truck springs, in addition to other tools and equipment standard to all repair tracks.

Very desirable metal horses and material racks can be made from scrap boiler tubes. Sufficient material racks should be maintained at all parts of the repair track to reduce the special delivery of material to a minimum.

Special tool racks should be provided to facilitate the handling, storing and checking of company tools.

Operation

The efficiency of operation of any repair track depends largely on the supervisory forces. It is, therefore, of primary importance that foremen in charge be selected with the greatest of care. While it is important that they have an intimate knowledge and previous experience in freight-car work, it is of perhaps greater importance that they have those qualifications for leadership such as good judgment, initiative, a sense of fairness for both the men and the company and the ability to organize the shop forces for the best production possible. For this reason prospective foremen should be given all special training possible prior to their promotion as foremen.

All cars set on the repair track for repairs should be carefully inspected for defects before the work is started. Foremen or inspectors responsible for inspection of cars should start the work of inspection in sufficient time ahead of repairmen to take care of this work. On most repair tracks foremen begin work approximately 30 min. ahead of the workmen.

An organization which provides prompt delivery of all special material to cars which is not available to the workmen at sub-supply points is also essential. It is the unanimous opinion of the committee that the men engaged in this work should be under the direct supervision of the car foremen to insure the most efficiency. While a few railroads employ efficiency men to make personal checks of various shops, most roads depend on the local foreman to see that all men under their supervision are reasonably efficient.

All railroads keep production records showing the number of cars repaired which are classified as to light, medium and heavy repairs and this is also used as a measuring stick for shop production, although the type of repairs on various light repair cars may vary greatly.

It is also important that each mechanic be furnished a standard set of company tools and that he be required to meet certain minimum standards for personal tools to be furnished by him. Regular inspections should be made of both company and personal tools so that all tools will be properly maintained and defective tools taken out of service as a safety measure.

Regular schedules should also be established for the inspection, lubrication and care of all special tools and equipment, including automotive equipment, jacks, pneumatic tools, etc.

Classified Work

The various classes of work should be classified and performed by special gangs whenever possible. Special gangs can be or-

ganized for truck and draft-gear work, woodwork, fit up, welding and riveting gangs for steel work, air-brake work, repacking journal boxes, etc. This not only permits the use of specially trained men, but also increases the efficiency of the shop.

Every effort should be made to cultivate the interest of the men in their work. Safety committees should be organized and special training offered to men interested in education and promotion. The best working conditions possible should be provided for the workmen at all times.

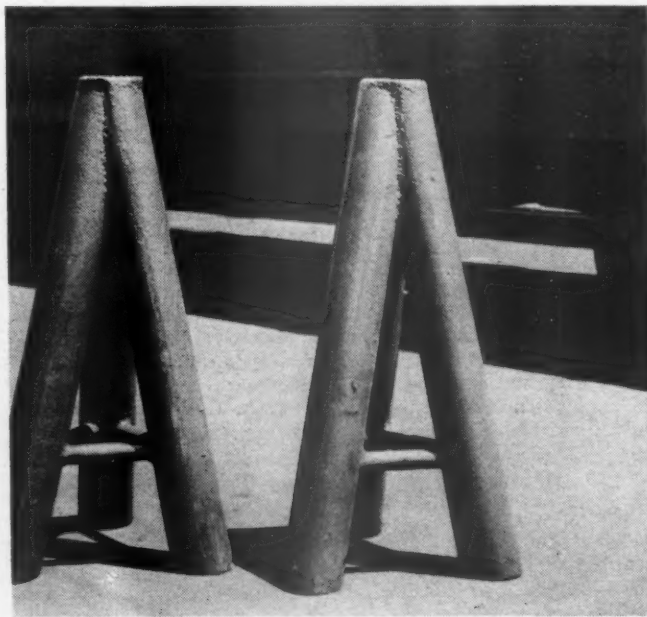
It will prove profitable for the railroads to send some of their local car department foremen to other railroad shops occasionally. These foremen would not only be encouraged to do better after seeing what the other fellow is doing, but would also bring back many good ideas which they could put into practice in their own shop.

While this report considers the subject from the standpoint of economy and efficiency of operation of light-repair tracks, the importance of reducing the delay to the movement of both loaded and empty equipment should not be overlooked. While the per diem charge for foreign equipment is only \$1.15, the loss to the railroad company on account of delays and loss of shipments is usually much greater. This is especially true at the present time due to the shortage of cars of most types.

The advent of the modern freight car on which the electric welding process is used extensively and also the rapid development of automotive shop equipment and other shop tools requires the careful, continuous study of car-department supervisors for efficient freight-car repair-track operation.

Discussion

This report was commended for the emphasis placed on one of the most important factors in the expeditious handling of freight traffic. One member said that easy accessibility of re-



Light, strong horses made of welded boiler tubes

pair tracks is essential, and that adequate facilities and tools will help make up for deficiencies in labor.

Another stated that both open and stub-end tracks can be used successfully with the spot system of light repairs, but only with full co-operation from the operating department. Too much pressure to reduce switching often seriously handicaps car-repair operations and increases costs. For example, if empty and loaded bad-order cars are sent to the repair tracks without being segregated, the work is handicapped and additional switching is required later.

The thought was advanced that the spot system extended to light repairs, using car pullers for all movements after bad-order cars have been set on assigned tracks, will reduce switching and, in fact, take car handling on the repair tracks out of the hands of the transportation department. The concentration of materials, tools and specialized men in a restricted area will also

effect marked economies and simplify supervision. The importance of separating cars on the repair tracks for complete coupler inspection and to save time getting around was emphasized.

The report was signed by Chairman B. J. Huff, assistant master carbuilder; C. & E. I., Danville, Ill.; C. E. Barrett, district general car foreman, C. M. St. P. & P., Minneapolis,

Minn.; N. E. Carlson, assistant master car builder, G. N., St. Paul, Minn.; J. C. March, assistant superintendent car maintenance, B. & M., Boston, Mass.; G. C. O'Keefe, equipment inspector, N. Y., N. H. & H., New Haven, Conn.; J. G. Rayburn, superintendent car shops, C. & O., Russell, Ky.; C. O. Young, assistant superintendent car department, I. C., Chicago.

Report on Lubrication Practices

Your committee, after careful consideration and investigation, has decided that opinions we might have or suggestions we might offer in regard to lubrication practices, would be of little value under current standards. We have therefore decided to present facts and suggestions with the idea of changing present standards so that accelerated progress can be made in the future.

The scope of present Rule 66 and standards in regard to materials and practices is entirely too broad to attain satisfactory performance.

Nearly all the cures for hot-box troubles cost money and management is reluctant to spend it for several good reasons—



K. H. Carpenter,
Chairman

one of them being no incentive to purchase better grades of materials unless the betterment is mandatory under A. A. R. standards and applicable to all roads and equipment.

We suggest that a comprehensive study be made of current A. A. R. standards by the present A. A. R. Lubrication Committee and we offer the following:

Present Specifications Too Broad

The current specifications covering oil, new waste and renovated packing are so broad there can be a vast difference in quality, yet A. A. R. standards in all cases will be met. It is necessary that specifications be amplified and more specific; we must have better materials if we are to progress above current performance. Waste specifications must spell out to the letter the kind of threads, length, lint content etc. What waste some railroads reject as unfit is accepted without question by another railroad and the latter's equipment is used over the former's line, so in reality Road 1 is still using materials rejected on account of undesirable quality. Under present specifications, journal boxes may be repacked with all wool, all cotton, or wool and cotton with practically any proportion of either and we are sure you will agree that this specification must be scaled down and restricted. If one mixture or kind is better, why not have the best and the better resulting performance?

What about short threads and lint? Some roads pay more money for waste with longer threads and less lint, some roads refuse waste with slasher content. Others specify it, yet all of it can be accepted under current specifications. Tests should indicate the most desirable mix and quality, then specifications should be written to guarantee more uniformity. If all cotton packing is satisfactory there is not much incentive for another road to purchase wool waste for journal boxes at additional cost.

A plea for closer specifications of journal-box closures and lubricating materials—Committee observes fourteen bad practices

Which is more desirable and economical, all things considered? Tests and study should bring out enough facts to justify more specific specification of contents.

A higher quality oil is necessary as present oils do not fill requirements in extreme weather conditions. They thin out too much in the summer and allow the packing to roll in the winter. Better quality is essential and specifications should be more exacting. Why cannot a free oil be furnished that will pour in winter and keep packing down in summer?

Packing Retainers Advocated

We strongly recommend the use of packing retainers in journal boxes and although they are not a cure all, tests and actual service indicate they hold the packing in place and eliminate many hot boxes. In warm weather they keep packing from fluffing and expanding, which is the primary cause of many hot boxes during the summer months. In cold weather they have a tendency to keep packing from rolling due to congealed oil. Retainers allow the oiler more time to add oil and make closer examination of bearings, wedges, etc. We know of no better investment in hot-box controls, but their application will have to be made mandatory by the A. A. R. if desired results are to be obtained.

There is real need for better journal bearings, closer tolerances and precision matching if improvement in performance is to be obtained. Journals turn at approximately 600 r. p. m. when trains are operated at 60 m. p. h. and this, with the heavy journal load, requires better bearings than we are getting today. Basically, the present journal-box assembly is sound and we have approximately 100 years of service to prove it, but a few minutes' study of the assembly and a check of tolerances will indicate we have not even begun to take advantage of what we can still do to improve the installation.

Improvements are desirable in dust guards. The standard wood guards just do not answer the purpose and we cannot keep dirt out of journal boxes unless a better guard is used. Wood plugs, if used, should be secured with retainers. Other types of plugs also justify continued application.

Journal-box lids are being studied by the A. A. R. with the idea of improvement. Checks indicate the present standard lid does not answer the purpose. Improvements in the lid itself must also be followed by improvement in the journal box as investigations indicate the mouth of the box can be improved in-so-far as the lid fit is concerned. Most of us will agree we should not operate cars with missing journal-box lids, but there is hardly any difference in the amount of dirt that can enter a journal box with a missing lid or a box with a poorly fitting lid.

The greatest improvement in hot-box performance can come from controlling the summer epidemic during July and August and we urge following the suggestions:

How to Reduce Hot Boxes

1—Keep packing low, as the warmer the weather the more packing expands and fluffs.

2—Oil thins out and lays in the bottom of box. Add sufficient free oil to bind the packing and keep it from rising higher.

3—Keep the packing iron out of boxes that are lubricating properly and where packing is in the proper place.
4—Hook all bearings for waste grabs.
5—Intensify inspection of bearings for defects. Remember it is the border line cases that fail in summer and intensified inspection will catch many before they develop.

6—Provide train-yard forces with plenty of good up-to-date equipment so that they can produce the quality of work required to keep down trouble.

7—Do something about this summer trouble now and do not wait until next July. Make requests on your management for improvements in control now. You know July and August will be with you again next year, so prepare now. We know that hot boxes can be effectively controlled through July and August if we have the equipment and manpower properly to prepare cars before they are forwarded.

Observation and inspection by members of this committee indicate improvements are necessary to effect better performance. Practices and conditions actually observed on some railroads which need correction follow:

Practices Which Need to Be Corrected

- 1—Waste improperly saturated.
- 2—Packing shipped in open drums, leaking and dirty drums.
- 3—Packing stored in unheated buildings, without covers and poorly fitted covers.
- 4—Packing not turned as outlined in Rule 66 or accumulated oil in bottom of tank not poured over top of packing.
- 5—The mouth of boxes in some cases so dirty that grit and other foreign matter are shoved into the box with the packing.
- 6—Blades of packing irons so short that the rear of journal boxes can not be reached.
- 7—Packing irons designed so that each time the lug of the iron is inserted under the lid to lift it the end of the blade strikes the dirt.
- 8—Journal oilers with spouts so short that free oil can only be applied half the length of the journal.
- 9—Cars allowed to operate with old repack dates; some cases have been noted where cars were moved off repair tracks with old dates.
- 10—Brasses and wedges laid in dirt during wheel exchanges.
- 11—Brasses applied without a coat of oil covering the lining.
- 12—Wheels applied to cars with journals improperly cleaned; some were found saturated with dirty kerosene which had been used in cleaning the journal of rust preventative and not wiped off.
- 13—Journals so badly scratched by the promiscuous use of wheel sticks that hot boxes are almost sure to result.
- 14—Cars switched at excessive speeds, resulting in waste grabs.

Ample Inspection Time in Train Yards

More time must be given the car oiler or inspector serving journal boxes by the ranking foreman, so the oiler or inspector will appreciate that his job is an important one and worthy of skill and intelligent effort on his part. He should be informed when he is doing a good job and getting results just as often as he is criticized for failures. We expect him to perform his work regardless of rain or snow, heat or cold and he generally does it without complaint.

To enable these men to apply their best efforts, packing oil, journal bearings and tools should be placed at strategic locations to save time in carrying them from the source of supply to the car or train. Saving steps for them allows more time for actual work and saves the energy of the employee to the benefit of the employer.

Increased time for oilers to perform their work, especially in train yards, is generally reflected in better operation. Therefore, the car foreman should always be on the alert to get the transportation department to give his men the train or part of it as soon as possible. Roads that consider this angle and practice it, generally speaking, have a better hot-box performance than some others.

Car foremen should insist that ample time be allowed to perform this work properly in train yards. We have too many cases of trains made up late and then expecting the oilers and car inspectors to O. K. them in a few minutes. We should not be backward in informing our managements that a good job can not be done under such conditions.

We should try to keep men informed as to the conditions which

affect their work. Many men do not know the abuse a journal must take when moving in a train. It would be well to explain what conditions exist when cars are heavily switched, moved over switches, turn outs, crossovers, high and low joints, at high speeds, the effect of end thrust on bearings, the effect of out-of-round wheels, brake-burn-comby wheels, and flat wheels on bearings, the effect of insufficient side motion on the heating of journal bearings, and many of the other conditions which affect bearings directly or indirectly.

Education Important

Oilers in many cases are put to work on cars who never worked for a railroad before and when the car foreman gives them the necessary equipment he lets them find out the hard way which methods are most desirable in performing their work. Any new man must be given all information possible in connection with his work and the foreman must stay with him until he has mastered his job. We are too prone to watch him for just an hour or so and figure he knows enough to get by. Our opinion is that he must have an intensified education of several days duration, at least, before he is capable of performing the work in the best manner.

Specifications pertaining to materials such as waste, oils, bearings, wedges, etc., have intentionally been broadened so railroads can use materials best suited to their individual requirements. However, even though the intent may be proper, no real effectual application of the rule can be made until the specifications are written to provide a first-class performance, consistent with economy and efficient operation.

There is room for improvement in all phases of wheel-shop operation from properly turning journals to mounting wheels. Entirely too much poor workmanship is permitted in many shops and, since we now have a more healthy labor situation, there is no reason to believe we must put up with it any longer. We know of improper machine work performed on axles in the past on some railroads which has reflected in undesirable hot-box performance.

The current Wheel and Axle Manual, if followed closely, will produce satisfactory wheels and axles. Therefore, it is only a matter of enforcing the application of the manual's rules to produce good material.

Discussion

In general, the report was highly commended although containing a number of controversial points. One member said that the report is encouraging because it shows dissatisfaction with present unnecessary defects and failures. Specifications should cover service instead of design. The opinion was advanced that Rule 66 should be streamlined to meet present needs, but killing the rule will not produce the desired results.

Discussion of what can be done to get better results under present A. A. R. rules brought out the statement that desired improvement will definitely follow closer adherence to the intent as well as the letter of the rules.

One member spoke strongly in favor of packing uniformity, as recommended in this report, and said that the committee must be backed up in its efforts to overcome present conditions whereby one railroad is compelled to operate foreign cars with packing definitely inferior to its own specifications.

The advisability or reason for putting a small quantity of water in journal boxes during exceptionally hot, dry, summer weather was questioned and the answer given that this water adds to the resiliency of the packing and tends to reduce journal bearing temperatures.

The report was referred to the A. A. R. Lubrication Committee.

The report was signed by Chairman K. H. Carpenter, superintendent car department, D. L. & W., Scranton, Pa.; J. F. McMullen, supervisor car repairs, Erie, Cleveland, Ohio; R. E. Baker, superintendent car maintenance, B. & M., Boston, Mass.; D. C. Davis, lubricating supervisor, A. T. & S. F., Topeka, Kans.; R. Winters, assistant passenger car foreman, C. & N. W., Chicago; D. Marshal, general car inspector, C. of G., Macon, Ga.; A. J. Pichetto, general air brake engineer, I. C., Chicago; H. S. Marsh, general car inspector, M. P., St. Louis, Mo.; G. D. Minter, division car inspector, N. & W., Portsmouth, Ohio; J. W. Hergenhan, assistant engineer, N. Y. C., New York.

Steam Locomotive Boilers

Master Boiler Makers' Association discusses five committee reports on the developments in boiler fabrication and maintenance practices which suggest the means for improving locomotive boiler performance

MEETING for the first time since 1941, over 250 members of the Master Boiler Makers' Association, exclusive of guests, gathered at the Hotel Sherman, Chicago, on September 4, 5 and 6 for the twenty-ninth annual convention. The meeting was opened by an address by President M. C. France, general boiler foreman, Chicago St. Paul Minneapolis & Omaha, who expressed his appreciation for the cooperation received during the war years from the association's committees in preparing reports and from other organizations supporting the association's activities when member meetings could not be held.

A short address was also made by T. F. Powers, assistant to the vice president, mechanical, Chicago & North Western who suggested to the members that they should broaden the scope of their knowledge by interesting themselves in other phases of mechanical department activities. Mr. Powers, a former boiler supervisor, could think of no reason why the chief mechanical officer could not be selected from any one of the sub-departments within the mechanical department. The final speaker at the opening session was Secretary-Treasurer A. F. Stiglmeier, general supervisor, boilers and welding, New York Central, who presented a message to the meeting in which he reviewed the progress of the association, its present sound financial status and the outlook for the future. He was confident that the association would continue to serve the boilermaking trade and the railroads by maintaining the high quality of reports and discussions on matters of vital importance.

During the meeting five committee reports were presented. As these reports were essentially the same as prepared for the 1945 annual proceedings of the association and have been printed in abstract in the *Railway Mechanical Engineer*, only a brief summary of parts of the reports pertinent to the discussion will be included in this issue. In addition to the committee reports a paper on steam locomotives was read by A. J. Townsend, vice-president, Lima Locomotive Works, and one on the use of alloy steels in all-welded boilers by H. L. Miller, Republic Steel Corporation. Mr. Miller's paper will be published in a later issue.

The officers elected to serve during the coming year are: President, Frank A. Longo, general boiler inspector, Southern Pacific; vice-president and chairman of the executive board, Sigurd Christopherson, supervisor boiler inspection and maintenance, New York, New Haven & Hartford; secretary-treasurer, Albert F. Stiglmeier, general supervisor, boilers and welding, New York Central. New members elected to the executive board for a three-year term are Harry C. Haviland, supervisor of boilers, New York Central; W. H. Keiler, locomotive inspector, Bureau of Locomotive Inspection, Interstate Commerce Commission, St. Paul, Minn., and E. E. Owens, general boiler inspector, Union Pacific. Because of the retirement from active service of Frank Yochem, former general boiler inspector, M. P., the association elected John P. Powers, system boiler inspector, Chicago & North

Western, to complete his unexpired term and E. H. Heidel, general boiler foreman, Chicago Milwaukee St. Paul & Pacific, to replace Mr. Yochem as secretary of the executive board.

The advisory board for the following year consists of A. K. Galloway, general superintendent motive power and equipment, Baltimore & Ohio, F. K. Mitchell, general superintendent motive power, and rolling stock, New York Central; E. R. Battley, chief of motive power and car equipment, Canadian National; B. M. Brown, general superintendent motive power, Southern Pacific, and H. H. Urbach, mechanical assistant to vice-president, Chicago Burlington & Quincy.

Advantages of Membership

The meeting was addressed by A. G. Hoppe, general superintendent locomotive and car departments, Chicago, Milwaukee, St. Paul & Pacific, and by E. R. Batley, chief motive power and car equipment, Canadian National, both of whom spoke on the benefits of the mechanical associations to the railroads.

Mr. Hoppe spoke of four advantages that the mechanical associations give to the membership. He said, "There is, first and foremost, the fact that in such organizations practical men meet and discuss the practical problems of their every-day work. The second benefit is the good derived from just meeting a lot of fellows who do the same work you do, have the same pride in their work and, as a matter of fact, have the same things to gripe about. The meeting of the old friends and the making of new acquaintances gives the individual member a lift not only in his work but also in his outlook on life which cannot be obtained in any other way.

"The third benefit is the opportunity to view the exhibits placed at your disposal by the railway supply men. We hear about this device and that gadget, or see a picture of it, but none of these is equal to actually seeing the equipment. The fourth of the major benefits is found in the proceedings of your association which gives the membership an opportunity to review at their leisure what went on at the meetings and to study the reports in detail to see to what extent they can be applied to your own particular problems."

In his address Mr. Battley said that ways of reducing costs must be found to offset the trend toward higher wages, shorter hours and increased material prices and to do this more efficient supervision is essential. "During a member's association and discussion with other men of the same rank," he said, "thought is stimulated and different methods of approach are discussed which may disclose hazards or advantages in a development that could not be perceived by the trend of thought of one individual, and as a result a railway problem might be solved without costly and unwise experiments."

Mr. Battley also pointed out that railroad men find it impossible to make frequent visits to other railroads and obtain first-hand information but by attendance at an association meeting they find out other methods of solving difficulties by talking to others with similar problems. Because the future of the railroads will depend largely on the caliber of the supervision, he referred to the opportunity for the young man to learn from the leaders in his particular field at the meetings of the associations and said "Much can be learned from their presentation of facts, their method of meeting people and their tolerance of other people's opinions." In conclusion, he said it is to the advantage of the



E. R. Battley



A. F. Stiglmeier



F. A. Longo



B. M. Brown

Master Boiler Makers' Association

Officers

1945-46

President: *Myron C. France, general boiler foreman, Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.*

Vice-President: *F. A. Longo, general boiler inspector, Southern Pacific, San Francisco, Calif.*

Secretary-Treasurer: *A. F. Stiglmeier, general supervisor boilers and welding, New York Central System, New York.*

Advisory Board

E. R. Battley, chief of motive power and car equipment, Canadian National, Montreal, Que.

B. M. Brown, general superintendent motive power, Southern Pacific, San Francisco, Calif.

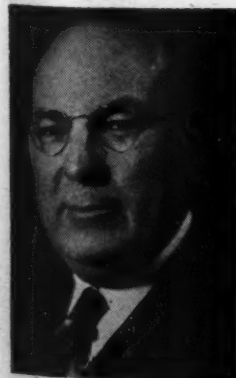
A. K. Galloway, general superintendent motive power and equipment, Baltimore & Ohio, Baltimore, Md.

F. K. Mitchell, general superintendent motive power and rolling stock, New York Central System, New York.

H. H. Urbach, mechanical assistant to executive vice-president, Chicago, Burlington & Quincy, Chicago.



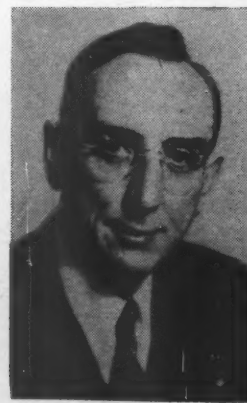
Myron C. France



A. K. Galloway



F. K. Mitchell



H. H. Urbach

railroads to urge supervisors and others to become members of the associations, to attend the meetings, to take part in the discussions and to make information available to them for factual committee reports.

Townsend on Steam Locomotives

In presenting a paper reviewing the progress made in the development of the steam locomotive and pointing out the possibilities for future developments, Mr. Townsend said, "Highly superheated steam, with pressure much higher than formerly believed practical, has contributed its share of development, and our present locomotive boiler with its internal firebox, and all appurtenances, such as grates, ash pans, refractory arches, feed-water heaters, superheaters, throttles, etc., being practically a direct part of the boiler is just about the most compact form of a steam generator in existence today, always ready to give the cylinders their steam supply. It has to be that way because of the restricted limits of clearance through which the locomotive must operate. The best grades of steel are used in construction, the tensile strength of which may be from 55,000 to 75,000 lb. per sq. in. according to its chemical composition and steels of higher tensile strength are likely to be had in the future.

"You are all familiar with the development of boiler design and manufacture, but I want to call your attention to the fact that working steam pressures have steadily increased within the memory of most of us and that logically higher pressures may come as greater efficiency is required. So keep up with your technique and have the latest information on welding, flame cutting, etc. The all-welded boiler is making its debut now, new welding practices making all this possible, safety being insured by the X-ray, that remarkable contribution of the medical profession. These welding developments are also making possible and practical the water-tube firebox which paves the way for further steam pressure increases, which have been of so much advantage in the past.

"We know the old iron horse has the heaves, but we also know that we have done something about it. Our eight per cent thermal efficiency is twice as much as it used to be, which means that we can produce the same power with half the coal we used to burn, or get twice the power out of the same coal that we once did, which ever way you want to look at it. We have accomplished this by learning more about the secrets of steam expansion and fuel combustion, and we have a lot more yet to learn on these subjects. A new cycle of steam cylinder operation is under experiment right now with many possibilities ahead. New systems of firing coal are being developed; burning

pulverized coal in combination with our standard firing methods and forced circulation is on the way, and you are all familiar with the progress of over-fire air jets and their success in smoke abatement.

"Many so-called gadgets have proved to be lifesavers, many more developments will come along later on, and I am confident that the steam locomotive is going to have a very interesting future. So whenever you hear that the steam locomotive is all done, washed up, and ready to be put away, just remember the old story of the hammer and the anvil—it was the hammer that wore out. Then go to any station or terminal almost anywhere, and once again take the advice of the grade crossing sign, 'Stop, Look, And Listen.' You will see many a steam locomotive going out with its train and you will hear the story of the exhaust barking up into the sky, 'I take you there; I bring you back.' And of course, if the drivers slip the old girl will tell you that she has been doing that for over 100 years; and then as she settles down to pulling again will repeat the century old story, 'I take you there; I bring you back.' And that, gentlemen, is the first principle of transportation, all the others follow after."

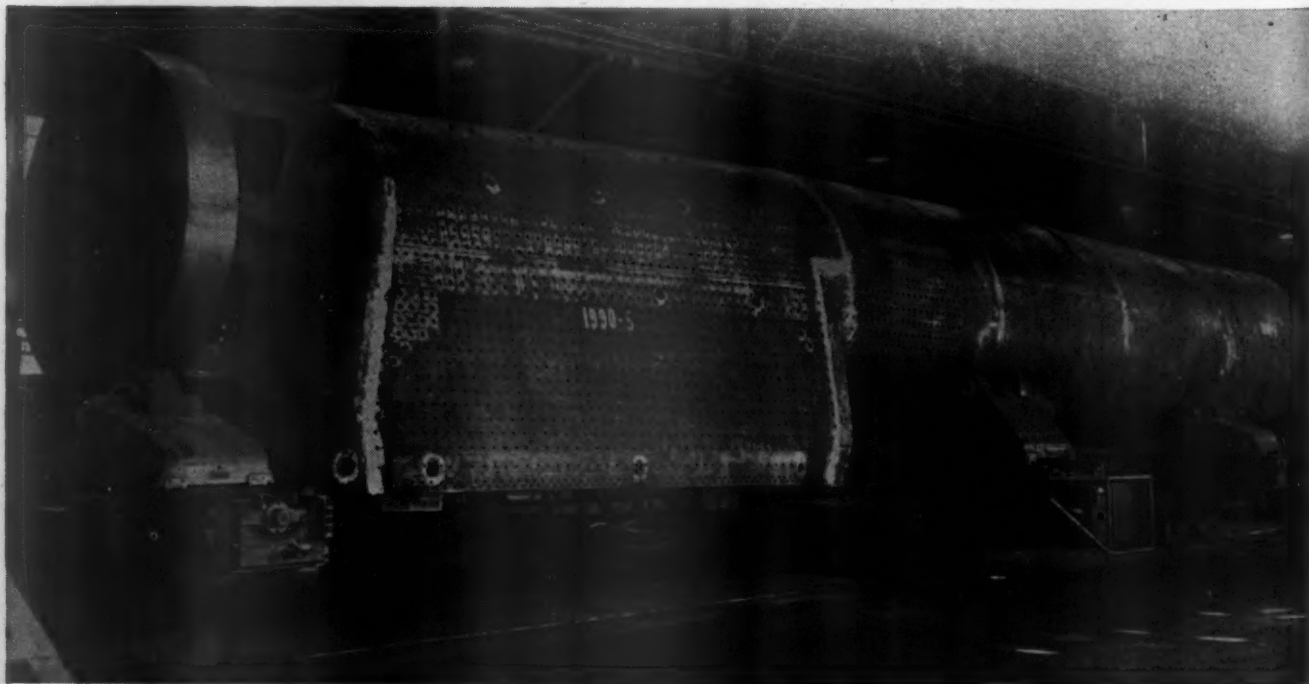
Report on Post-War Boilers

An abstract of the committee report on Topic No. 1, "Proposed Planning and Fabrication of Post-War Locomotive Boilers and X-Ray Developments," was presented by E. H. Heidel, chairman of the committee.* This report dealt in its entirety with the history of the all-welded boiler, the fabrication of the first all-welded boiler for the Delaware & Hudson in 1937 and its performance to date, and included the general specifications under which the two boilers completed early this year for the Canadian Pacific and new boilers ordered for the D. & H. and the New York Central were to be built. It also included a report on the use of X-ray as a fundamental step in the welding of locomotive boilers. The committee recommended the all-welded boiler and felt that boilers so constructed should be made a standard fabrication procedure.

Discussion

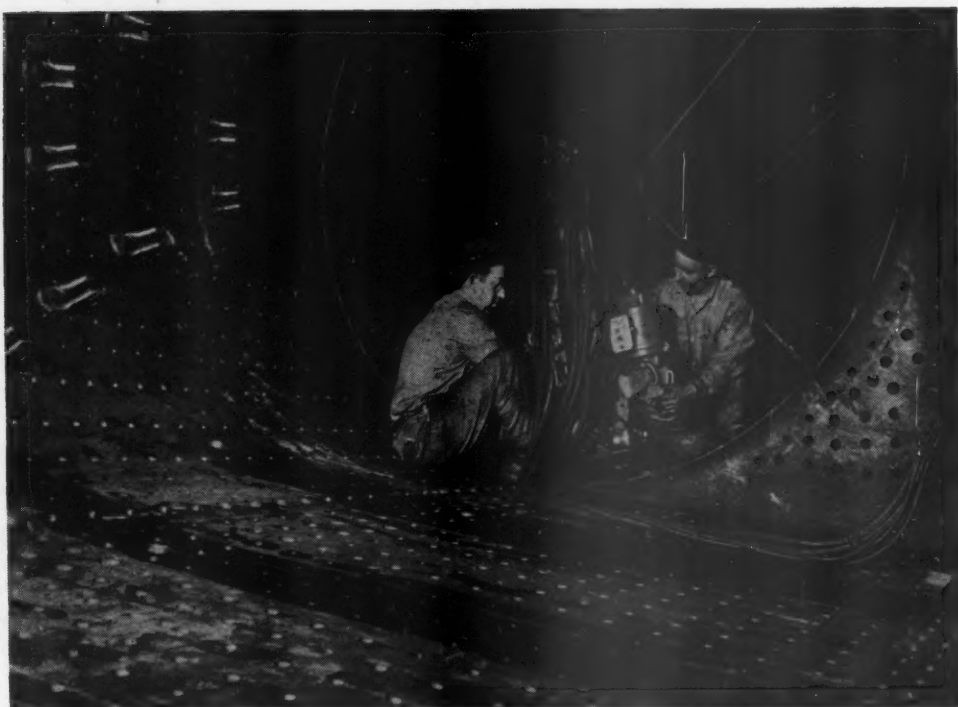
Discussion on this topic started with a question from the floor as to value of the construction of boilers without steam domes, specific reference being made to the design of the Canadian Pacific all-welded boilers which were built without domes. The opinions of those present were favorable to this design, A. F. Stiglmeier

* See the November, 1945, issue of the *Railway Mechanical Engineer*, page 527.



Completely all-welded boiler for Delaware & Hudson's 4-6-6-4 type locomotive on positioning rolls for closing weld at Alco's Schenectady plant

Special equipment in place for making the closing weld between the third course and back end of the new all-welded D. & H. boiler



reporting that the New York Central has 24 locomotives operating and giving good service without steam domes and J. P. Powers referring to the six all-welded boilers on order for the Chicago & North Western, all to be built without steam domes. Arthur Williams, chief engineer, the Superheater Company, mentioned the studies made of the conditions existing inside a boiler under operating conditions by the use of glass apertures in the boiler which showed that steam domes were of little value until the water foamed and then no dome had the capacity to handle the foam.

In a written discussion of the topic, C. L. Combes, associate editor, *Railway Mechanical Engineer*, introduced data to show that the steam locomotive is the most important motive power



E. H. Heidel,
Chairman

unit but also showed that current orders are favorable to the Diesel-electric locomotives. Because boiler maintenance is one of the primary handicaps that the steam locomotive has he was of the opinion that all-welded boilers (23 of which are on order in addition to three in service) and the seal welding of staybolts would improve the competitive position of the steam locomotive by reducing boiler maintenance. A development that may have an effect on the future of conventional steam locomotives, the use of pulverized coal, was suggested by Mr. Combes as a solution to other disadvantages of the steam locomotive; namely, the elimination of ashpit delays and facilities; building, cleaning and dumping of fires, and smokeless, cinderless and sparkless operation. These advantages, he pointed out, may be obtained because of recent development work for the coal-burning gas-turbine locomotive in which pulverizing equipment to be installed on the locomotive has been made a practical reality.

H. S. Swan, general welding supervisor, American Locomotive Company, summarized briefly the procedures and equipment used currently in the production of all-welded boilers. In his talk he brought out the importance of fit-up prior to welding because of the use of the automatic welding process, the method of the X-raying of the welds and details about the stress-relieving furnace. In answer to a question asking if anyone can judge the extent of the defects by X-ray pictures Mr. Swan said that the X-rays were not at all difficult to analyze for defects and also that the exact location and depth of a defect could be determined by the X-ray technique. The latter made it possible to chip out defects during the initial boiler construction without going entirely through the weld which made rewelding easier.

The members of the committee who presented this report are E. H. Heidel (chairman) general boiler foreman, Chicago, Milwaukee, St. Paul & Pacific; A. F. Stiglmeier (vice-chairman), general supervisor boilers and welding, New York Central; E. C. Haase, vice-president, Oxweld Railroad Service Co.; J. H. Lewis, assistant general boiler inspector, Atchison, Topeka & Santa Fe; A. G. Trumbull, general mechanical engineer, Chesapeake & Ohio; W. R. Hedeman, engineer of tests, Baltimore & Ohio; E. Magee, welding foreman, Central of New Jersey and J. W. Kenefic, superintendent railroad service, Air Reduction Sales Co.

Report on Water Treatment

An abstract of the report on Topic No. 2,* "What Water Treatment Has Done for the Railroads and what Is to Be Done to Further Improve Locomotive Boilers," was read by the committee chairman, John P. Powers. This report contained statistics to show the savings obtained by treating boiler feed waters, the figure of 30 million dollars being used for the estimated monetary savings. Other advantages of water treatment given included a reduction in fuel consumption, making possible long runs by steam locomotives, savings of a substantial tonnage of steel and its contribution to the increased availability of the steam locomotive. The report also quoted the latest available figures given by the *Railway Engineering and Maintenance Cyclopedia*, which estimated that water treatment is being used at 5,000 water stations and that there are 8,250 additional stations at which water treatment could be used with economy.

Discussion

All discussion of the report was very favorable to the use of water treatment. S. C. Johnson, vice-president, Dearborn

* See page 575 of the December, 1945, issue of the *Railway Mechanical Engineer*.

Chemical Company, referred to the extension of water treatment suggested by inference in the report and gave four reasons why a greater use of water treatment was needed. These were: "(1) The demands of water treatment are now more exacting than heretofore; (2) it has been found necessary to treat supplies heretofore considered as good boiler waters; (3) uniform treatment of all supplies by engine districts is rapidly becoming more of a reality and (4) for the first time in water treatment history it is now possible to put anti-scale treatments, anti-pitting chemicals and anti-foam materials into one treatment. This means more highly effective water treatment than was ever before possible and stresses the importance, from the standpoint of economy, of properly conditioning practically all boiler feed-water supplies by engine districts.

"Although this relatively new improved water treatment technique is only recently available, it is nevertheless worthy of careful and thoughtful consideration. Another problem coming on with a rush is the proper conditioning of water used in the flash type boilers used quite generally as steam generators on Diesel powered passenger trains."

Frank Yochem, in citing the experience on the Missouri Pacific of relatively new boilers developing cracks in the seams and rivet heads with a mush-room-like structure, wanted to know if the conditions were caused by water treatment, poor steel or



E. H. Gilley,
Chairman

poor workmanship. H. H. Service, general boiler inspector, Atchison, Topeka & Santa Fe, believed a cause to be the use of nickel-steel rivets and said his railroad changed from nickel-steel to carbon-steel rivets and had no trouble thereafter. John P. Powers told of experiencing the same troubles and said all rivet holes were being drilled in boilers on his railroad after the plate was rolled, to eliminate the cracking in the seams. A. F. Stiglmeier made the statement that he thought his railroad had experienced more boiler cracking than any railroad in the country. Believing the cause not to be boiler feedwater but workmanship, his railroad put a tolerance of .006 in. for fitting-up work in fabricating boilers and used a low tonnage in driving the rivets, with excellent results. James A. Gaulty, assistant superintendent, American Locomotive Company, Schenectady, told of the 1,500-ton press used by Alco to bend the edge of the boiler plate before it goes into the rolls in order to get a good fit-up at the edges of the plate for riveting. He agreed with Mr. Stiglmeier that good fitting-up was essential and referred to the practice of his company of double reaming the rivet holes and of using a pressure of 85 tons per square inch of rivet cross-sectional area. He suggested that more and smaller rivets would produce a dry seam.

The members of the committee were J. P. Powers (chairman), system boiler inspector, Chicago & North Western; H. L. Harrell (vice-chairman), shop engineer, Illinois Central; F. A. Longo, general boiler inspector, Southern Pacific; B. C. King, general boiler inspector, Northern Pacific; H. C. Haviland, supervisor of boilers, New York Central; I. N. Moseley, master boiler maker, Norfolk & Western, and E. H. Gilley, general boiler foreman, Grand Trunk.

Report on Cinder Cutting

While the report on Topic No. 3 dealt mainly with the cinder cutting of boilers it also included a section on the slagging and

washing of flues and tubes.* The report, presented by the committee chairman, E. H. Gilley, was comprised of the information furnished by 20 railroads on the experience of each railroad with cinder cutting, the means they have used in the past to combat it and their plans for reducing or eliminating it in the future. In general, the cinder cutting of flues, tubes, crown bolt and staybolt heads and smokebox appurtenances is a problem on most railroads. The high velocity of the gases of combustion caused by the trend toward the utilization of steam



J. P. Powers,
Chairman

locomotives at full capacity has increased the abrasive action of cinders and other particles in the gas stream. Most of the action taken to combat cinder cutting, as given in the report, consists of local measures to protect the parts from the cutting action. The section devoted to slagging showed that the type of coal was the main factor in causing slag while the method of firing, and moisture on the firebox sheets and in the flues contribute to its formation and sticking to the firebox and flues. The report recommended washing flues and tubes rather than blowing them out with compressed air. It included a description of the procedure and equipment required and gave data to show the advantages of this practice. Both the section of the report on slagging and that on flue washing were prepared by S. A. Wentz, assistant supervisor of boilers, New York Central, Cleveland, Ohio.

Discussion

In the discussion of the report A. F. Stiglmeier introduced figures showing that the New York Central was steadily increasing the use of flue washing, having washed 1,163 locomotives in January, 1946, and 1,862 in July, 1946. He said that his railroad did not know what it is to have plugged flues. E. E. Owens, who submitted an individual report on cinder cutting, spoke of the beneficial effect of Circulators properly located in the firebox in reducing cinder cutting wear. To eliminate cinder cutting he believed that either a new boiler design or the use of pulverized fuel was needed. J. H. Lewis, assistant boiler inspector, Atchison, Topeka & Santa Fe, said that on their Mikado-type locomotives they first applied thimbles which increased the mileage but that these had to be frequently renewed. Then baffles were tried in the front end to retard the gas flow through the outside flues but this arrangement did not eliminate cinder cutting.

The members of the committee were J. P. Powers (chairman), general boiler foreman, Grand Trunk; E. E. Owens (vice-chairman), general boiler inspector, Union Pacific; S. F. Wentz, assistant supervisor of boilers, New York Central; A. P. Robertson, district boiler inspector, Great Northern, and W. Henry, general boiler inspector, Canadian Pacific.

Report on Staybolts

The committee submitted to the meeting a supplement to the report on staybolts published in the 1945 annual proceedings of the association,† an abstract of the complete report being read by Sigurd Christopherson, the committee chairman. The

* See page 590 of the December, 1945, issue of the *Railway Mechanical Engineer*.
† See page 75 of the February, 1946, issue of the *Railway Mechanical Engineer*.

supplement gave additional supporting data to show the value of the top boiler check, feedwater treatment, a skimmer for feedwater condensate and the seal-welding of staybolts. These items were discussed in the 1945 report and all of them have demonstrated their worth in stopping or reducing staybolt leakage. Other factors affecting staybolts and side sheets that were discussed in the 1945 report included the proper operation of the feedwater pump, the cooling down and washing of boilers, water circulation in the boiler, staybolt thread fits and staybolt application.

Discussion

The discussion gave added verification to the points brought out in the report with general agreement on the value of the top boiler check, feedwater treatment, oil skimmers, water circulation and seal welding. In referring to the top boiler check one member said that a splash plate on top of the dry pipe will do the same thing as a spray device and will eliminate the objection to the space required for the spray equipment. Experience on one railroad with 50 locomotives equipped with top boiler checks also showed that water treatment is necessary. When one of the locomotives was operated with untreated water it leaked "like a sieve" after one week of service. On the New York Central one of 26 locomotives was delivered with no spray nozzle to the top boiler check. It started to leak after a short period and after being taken out of service and having the boiler cleaned and a spray nozzle installed it has given no



S. E. Christopherson,
Chairman

trouble from leaky staybolts after approximately 175,000 miles. Increased water space obtained by the use of wider fire legs was also given credit for improving water circulation and improving boiler performance.

The members of the committee were S. E. Christopherson (chairman), supervisor of boiler inspection and maintenance, New York, New Haven & Hartford; F. Yochem (vice-chairman), general boiler inspector, Missouri Pacific; I. Johnson, boiler foreman, Chicago, Great Western; G. Cravens, foreman boiler-maker, Texas & Pacific; L. A. Roberts, assistant supervisor of boilers, Boston & Albany; F. P. Huston, research engineer, International Nickel Co.; M. H. Cleaver, service engineer, Paige-Jones Chemical Co.; H. Mastin, service engineer, Dearborn Chemical Co.; W. Masters, sales engineer, Flannery Bolt Company; B. E. Larson, mechanical engineer, Locomotive Firebox Co., and A. H. Willett, mechanical engineer, American Arch Co.

Staybolt Materials and Application

In a paper presented at the meeting Dr. G. R. Greenslade, director of research, Flannery Bolt Company, Bridgeville, Pa., said "Some years ago, when a relatively large number of manufacturers were making staybolt iron, there was sufficient tonnage and a sufficient number of brands to take care of the needs of the various railroad boiler shops as well as those of the locomotive manufacturers. This situation has changed greatly during the last several years, so that now there are but a relatively few brands of staybolt iron on the market, and during the war the output was entirely too low to take care of the requirements for locomotive firebox staybolts. This condition caused an extreme shortage, and the result was that since the beginning of the war more and more steel has been

used in the production of staybolts. Most of this has been used in locomotives built for the government for use by the armed forces and for foreign shipment such as lend-lease. The steel manufacturers have now become generally aware of the fact that there is a real need for good staybolt steel; steel which, when compared in every known way with staybolt irons, will perform favorably and which, they hope, will be better than any steel produced heretofore.

"We feel that the progress made to date, not only in regard to the testing of these products, but progress in regard to the materials themselves, is quite encouraging. A great many locomotives have been equipped with one or another of these newer staybolt steels. In saying 'newer', I am casting no reflection on any of the older types of staybolt steels which have been on the market for years, and which have already proved their usefulness—but I nevertheless say (without bias or partiality to any manufacturer whether of staybolt iron or of steel) that there is a great need for a better staybolt material, be it iron or steel.

"As one might expect, some of the materials tried were relatively poor. Others submitted by metallurgists in the hope that a strong, stiff, resilient material would solve the staybolt breakage question, turned out to be of little use on account of being too stiff. You cannot use a staybolt material which is too stiff, as it will spread the holes in the fire sheets and cause leakage. It will also introduce unusually large stresses in the fire sheet, and cause fatigue cracking.

"Any material which will not rivet over well without cracking at the circumference of the head is questionable as a staybolt material to be used in fireboxes made of any of the standard firebox steels.

"A firebox having a flexible staybolt installation will tolerate a stiffer staybolt material than will one equipped with rigid stays. This is because the fiber stress due to flexure in a rigid staybolt, at the surface of the section where it engages the fire sheet on the water side, is twice as great as that of a flexible staybolt at the same location. This means that the rigid staybolt exerts a greater prying action on the sheet and therefore causes it to be stressed much more than does a flexible staybolt."

Using formulae given in mechanical engineering handbooks, Dr. Greenslade included in his paper a mathematical demonstration to show the maximum fiber stress in rigid staybolts to be twice as great as in flexible staybolts. Referring to the computation he said it applies "only to the portion of the stress introduced by bending and does not take into account at all the stress caused by the pressure of the steam in the boiler. However, the bending stress caused by the relative movement of the fire and wrapper sheets is far greater than is the tensile stress due to boiler pressure. It is not boiler pressure that is the prime cause of staybolt breakage, but distortion of boiler parts due to thermal expansion."

He then described the test equipment and procedure used in conducting vibratory tests on staybolts for the purpose of obtaining general information such as the effect on the staybolt and the sheet of good and bad thread fits and riveting up. The tests are made with two eight-inch square sections of boiler plate having four staybolts, the plates being $\frac{3}{8}$ -in. and $\frac{1}{4}$ -in. to represent sections of the firebox sheet and the wrapper sheet, respectively. The riveting of the staybolts is done by beginning with heavy upsetting flows and finishing with lighter blows. The importance of this upsetting procedure was emphasized as it "expands the threads completely through the firebox sheet and even beyond, to such an extent as actually to expand the tapped hole in the sheet."

Speaking of the test results Dr. Greenslade said, "When these test assemblages are subjected to repeated reverse stresses such as those produced by the machine described, eventually one or more of the bolts in the assemblages will break, providing that the thread fits are tight and further providing that they remain tight during the test. Our experience shows that if a thread fit is right and if the riveting up has thoroughly expanded the threads to make a tight joint all the way through the sheet, the bolt will break off practically at the sheet surface on the water-space side. If, however, the riveting up has expanded the bolt only part way through the sheet, then the bolt may break off one, two, or even three threads within the sheet.

"Bolts which are of materials of too high tensile strength will enlarge the holes in the sheets until the bolts can swing back and forth without a great deal of restraint. Such bolts may

remain unbroken over very long test periods, but as staybolts they would be of little value. In service they would leak and would, in many cases, damage or ruin the fire sheets. The leakage might be stopped for a time by bobbing up now and then, but the damage to the sheets cannot be cured and the sheets must be renewed.

"From this you can see that even when you have a fairly good thread fit, if the heading up is done by light peening blows so as merely to flow the surfaces metal down to form a head, you will soon be in trouble as you will have excessive stresses on these heads due to lack of proper support throughout the thread fit. Similarly, a bolt well prepared from the standpoint of thread fit only, then seal-welded without first being driven up to provide a well expanded pressure fit will be short lived from the standpoint of trouble-free service. Our test experience shows that these welds will, in many cases, soon crack.

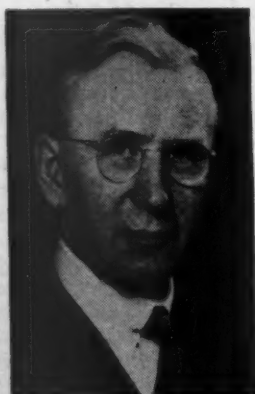
"I reiterate that it is difficult to over-estimate the importance of properly expanding the staybolt throughout the thread fit during riveting up. You experienced boiler makers know that it is the first few head-on blows that can do the trick.

"We plan to continue this experimental work for a long time to come and we hope that it will yield considerable information on many phases of firebox and staybolt service. Our work to date covers much more than what I have touched upon here and we have in our laboratory hundreds of samples and complete tabulated data covering this work. It is all available for your inspection and we will be only too glad to spread it out before you when you come to our plant at Bridgeville, Pa."

Report on Flues and Tubes

R. W. Barrett, chairman of the committee and chief boiler inspector, Canadian National, presented the report on Topic No. 2, "Application and Maintenance of Flues and Tubes, with and without Copper Ferrules," which included a supplement to the report prepared for last year.* In the supplement Mr. Barrett said:

"A study of the reports for the past eight years clearly indicate that there are two outstanding problems in connection with tube and flue maintenance for which solutions are being sought: (1) Cinder cutting of tubes and flues and (2) longitudinal cracking of tubes and flues through beads at the firebox end. As the first, that of cinder cutting, is being considered under



R. W. Barrett,
Chairman

a separate topic this report will be confined to the problem of tube and flue cracking.

"In all of the previous reports various methods of applying tubes and flues have been outlined, some with copper ferrules and some without, some using improved safe-ends, some countersinking or countersinking holes and some trying patented flue-ends, all of which had one end mainly in view, that of overcoming longitudinal cracking through beads.

"These improved methods, in the hands of their originators, have unquestionably resulted in prolonging the time before the cracking starts. Others have tried them out only to be dissatisfied with the results. It is evident that there are certain factors which are encountered in some territories which will affect

the results. In the experience of the writer this factor is chiefly water condition. On the railroad system with which he is associated there are hard- and soft-water districts. In the hard-water territories where the hardness of the water ranges from 10 to 20 grains per gallon the longitudinal cracking of tubes and flues is practically negligible. This was true when the tubes were formerly welded to firebox tube sheets at first No. 5 repair and also with the present method of welding to sheets at the application of tubes and flues, whereas on the soft-water districts where the hardness of water is from 0.2 to 3.0 grains per gallon and silica content relatively high the cracking of tubes and flues has given much concern.

"Questionnaires were sent to all leading railroads in the United States and Canada, to ascertain as to what extent copper ferrules had been omitted from tubes and flue applications, also as to what mileage was obtained before they began to crack longitudinally at the firebox end.

"The combined experience of these railroads would indicate that the application of copper ferrules was not responsible for the longitudinal cracking of tubes and flues, and that in general this cracking commenced at a considerable lower mileage where the coppers were omitted than it did where they were applied, it being evident that the coppers act either as a conductor of the heat from the bead or convey the cooling effects of the boiler water to the bead."

Individual Reports

S. G. Longo, assistant general boiler foreman, Southern Pacific, reported: "On engines equipped with combustion-chamber fireboxes, four years' service is obtained on the flues and flue sheets. On other engines with flanged sheets and welded construction we are only getting two years' service account of excessive fire cracking of tubes, flues and back flue sheets and knuckles cracking all around. On the beaded flues applied with coppers we get two years' service. We find that we get better results from the welded type flues, countersinking the flue sheet 1/4-in. deep and eliminating copper ferrules. Tubes are applied with copper ferrules while the flues are not. These locomotives are operating in soft-water districts."

A. D. O'Neal, chief boiler inspector, Pere Marquette, submitted the data shown in the accompanying table with the following statement: "Herewith a comparative test on four types of locomotives on which forty-two full sets of tubes and flues were applied with and without ferrules. The tabulation indicates the

Test of Copper Ferrules

No. of locos.	Boiler press., lb. per sq. in.	No. and dia. of tubes	No. and dia. of flues	Length, ft.-in.	Mileage without copper ferrules	Mileage with copper ferrules
24	200	210-2	32-5 1/2	15-0	good results	245,000
6	190	176-2	28-5 3/4	20-0	140,000	240,000
8	200	216-2 1/4	40-5 1/2	19-0	130,000	240,000
4	245	74-2 3/4	202-3 1/2	19-0	80,000	210,000

average mileage made before retubing was necessary, which was sixteen months to two years without ferrules, and three and one-half to four years with ferrules. The method employed in setting was the same in both applications."

I. N. Moseley, master boiler maker, Norfolk & Western, reported: "Our experience with the application of tubes and flues without copper ferrules has been rather limited. About two years ago, in order to get away from trouble experienced with the copper ferrules creeping out under the beads and preventing a good seal-weld, especially on 4 1/2-in. flues, we applied the tubes and flues without ferrules on a number of locomotives. The omission of the ferrules did not make much difference in the amount of fire cracking of the beads. On a few locomotives there was less cracking; while on the majority there was little or no difference. In no case did the omission of the ferrules increase the cracking.

"On some locomotives having 2 1/4-in. tubes 24 ft. long, trouble was experienced after about 50,000 miles with the tubes cracking circumferentially at the bead. We attributed this failure to the vibration of the long flue, which may have been previously cushioned and prevented from cracking by the copper ferrule. Where the size and length of the tubes are such that trouble is not experienced from breakage at the bead caused by vibration, it is thought that the omission of the ferrule is a step in the

* See page 24 of the January, 1946, issue of the *Railway Mechanical Engineer*.

right direction, as it enables a much better seal-weld to be made." B. C. King, general boiler inspector, Northern Pacific, referred to his minority report of last year on the application of tubes and flues without the use of copper ferrules and reported essentially the same results this year with additional data to show the excellent results obtained on his railroad without the use of copper ferrules. He said that, after ten years of applying tubes and flues without the use of copper ferrules with continued success, he would not go back to the use of ferrules.

The members of the committee were R. W. Barrett (chairman), chief boiler inspector, Canadian National; I. N. Moseley (vice-chairman), master boiler maker, Norfolk & Western; B. C. King, general boiler inspector, Northern Pacific; S. A. Longo, general boiler foreman, Southern Pacific; A. D. O'Neal, chief boiler inspector, Pere Marquette, and C. E. Bodine, general boiler foreman, Missouri Pacific.

Investigation of End Cracking

The results of an investigation made by A. T. Westbrook, assistant test engineer, Canadian National, on the end cracking of superheater flues welded to the tube sheet and dealing particularly with the relation between the welding and the propagation of cracks are given here. The welding tests were conducted under conditions similar to the following practical applications: Test No. 1—flue welded on application with water in the boiler; Test No. 2—flue welded on application without water in the boiler, and Test No. 3—flue welded on application, flue end and tube sheet preheated to 400 deg. F.

Test Observations

Test No. 1—The cooling effect of the water decreased the depth of heat penetration, decreased the heat affected area, increased the tendency of the weld to form a hard structure and set up a concentrated tension stress in the vicinity of the weld. Indications of a tendency to form scattered areas of a comparatively hard structure were found near the fusion zone and in the weld metal.

Test No. 2—There was a deeper penetration of heat, slightly slower cooling rate, less tendency to form a hard structure and less localized stress than in the case of Test No. 1. The tendency to form a hard martensitic or troostitic structure was negligible from the practical aspect of the problem.

Test No. 3—The structure was very similar to that of Test No. 2. The preheating effected a deeper penetration of heat and possibly a slight decrease in the localized stress.

Test Conclusions

(1)—The unavoidable coarse grain found in the weld zones of the three specimens decreases the ductility and to a slight extent increases the hardness of the metal, however, in the examination of cracked flues no connection was established between the coarse structure and the development of the cracks.

To refine this structure would necessitate the impractical operation of heating the metal to approximately 1,500 deg. F. and it is believed that the detrimental effects of such a treatment, if applied to the tube sheet, would outweigh any benefits derived.

(2)—Welding with water in the boiler increases and concentrates the welding stresses and increases the tendency to form a hard structure that may, in combination with tension stress, lead to cracking of the weld. No actual occurrences of cracks from this cause were encountered.

(3)—Welding without water in the boiler decreases the detrimental tendencies noted in (2).

(4) Preheating before welding decreases the welding stress to some extent but has the disadvantages that the greater depth of heat penetration increases the possibility of copper penetrating the grain boundaries of steel and causes the outer edge of the heat-affected zone to extend further along the surface of the flue. The metal at the outer edge of the transition zone is in a weakened structural condition and consequently if this zone is extended to coincide with the area in which the cracks originate it will become a factor in accelerating the propagation of the cracks.

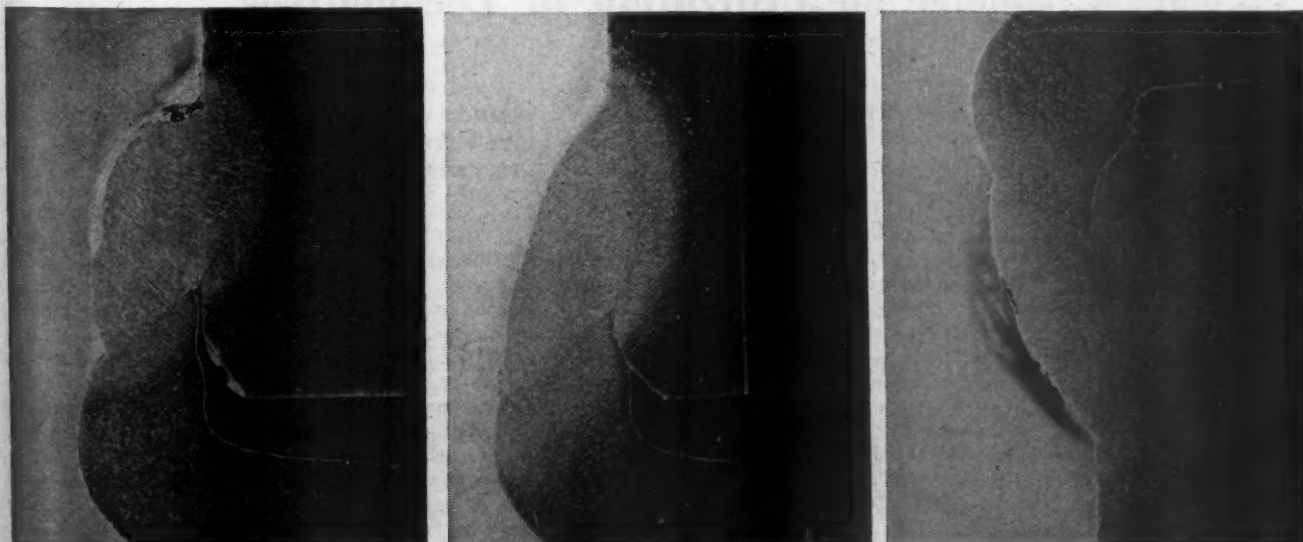
General Conclusions

As far as the limited scope of the investigation permits, it is concluded that the transverse cracking of flue ends in cases similar to the one considered is primarily the result of a stress-oxidation couple and any steps that may be taken to decrease the stress or the oxidizing action will tend to delay or prevent the defect. The stress induced by the upsetting and contraction process would be decreased by a reduction in the service temperature of the metal in this area that may possibly be achieved by decreasing the thickness of metal at this point, decreasing the protrusion of the flue beyond the tube sheet and by preventing, as much as possible, the formation of such insulating scales as are formed by calcium and magnesium sulphates and silica.

The possible advantage of the use of alloys to increase the creep resistance of the material in the flue suggests itself as a means of partially alleviating one of the causes of the defect.

Stress relieving at 1,150 deg. F. would decrease the locked-up welding stress at the end of the flue. A uniform and carefully applied stress relief at this temperature would be of value but would not, in itself, eliminate the flue-cracking condition.

Following the welding operation by mechanically cold working the surface area where the cracks originate would remove the welding stress and induce a more or less beneficial compression stress. Periodic cold working of this vulnerable area would neutralize the gradual stress build-up that occurs during service and greatly assist in preventing the end cracking of the flues. The method and severity of the cold work required to produce the desired results may be determined in conjunction with microscopic examinations of test specimens to determine the depth and extent of the deformed structure.



Left to right—Weld zones of Tests Nos. 1, 2 and 3, respectively, showing the differences in structure caused by varying welding conditions

R.F. & T.E.A. Convention

AT ITS annual meeting held in Chicago on September 4, 5, and 6, the Railway Fuel and Traveling Engineers' Association presented at five sessions a program consisting of nine committee reports and seven addresses. The registered attendance totaled 495 members and guests. All sessions were well attended and interest was sustained throughout.

Reports were presented on Air Brakes—Passenger-Train Handling; Front Ends, Grates, Ashpans, and Arches; the Utilization of Motive Power; the Road Foreman and the Diesel Locomotive; Locomotive Firing Practice—Oil; Locomotive Firing Practice—Coal; Smoke and How It Can Be Eliminated; Coal, and Fuel Statistics. Those on Passenger-Train Handling, Locomotive Firing Practice—Oil, on Coal, and on Fuel Statistics were prepared last year and were presented without discussions. All but the latter will be found in the November, 1945, *Railway Mechanical Engineer*, beginning on page 491. That on Fuel Records and Statistics appeared on page 578 of the December issue.

The addresses were made by H. H. Urbach, mechanical assistant to the vice-president, Chicago, Burlington & Quincy, who spoke on locomotive operation on the Burlington; Carl D. Stewart, vice-president, Westinghouse Air Brake Company, who spoke on Developments in Air Brakes; Theo. Olson, superintendent motive power, Chicago Great Western, whose subject was The Road Foreman and Education of Enginemen and Firemen; O. L. Olsen, regional service manager, Electro-Motive Division, General Motors Corporation, who discussed Diesel locomotives; A. L. Brodie, technologist, The Texas Company, who spoke on the characteristics of petroleum products; R. L. Ireland, Jr., president, Hanna Coal Company, who talked on the relations between the coal mines and the railroads, and J. I. Yellott, director of research, Locomotive Development Committee, Bituminous Coal Research, Inc., who described the present status of the

Nine committees report on various aspects of fuels, on firing practice and on problems related to power operation and maintenance

coal-burning gas-turbine locomotive, and the future steps in its development. Abstracts of those of Messrs. Stewart, Brodie, and Yellott will appear in later issues. The remainder are included in the following pages.

Election of Officers

The following officers were elected to serve during 1946-47: President—W. C. Shove, general road foreman of engines, New York, New Haven & Hartford, New Haven, Conn. Vice-Presidents—G. B. Curtis, road foreman of engines, Richmond, Fredericksburg & Potomac, Richmond, Va., and S. A. Dickson, supervisor fuel economy, Alton, Bloomington, Ill. Secretary-treasurer—T. Duff Smith. Executive Committee—C. E. Alexander, road foreman of engines, Illinois Terminal Railroad, Alton, Ill.; G. E. Anderson, general fuel supervisor, Great Northern, St. Paul, Minn.; F. A. Cutter, road foreman of engines, Chicago & North Western, Milwaukee, Wis.; R. D. Nicholson, road foreman of engines, New York, New Haven & Hartford, West Haven, Conn.; W. D. Quarles, superintendent Diesel performance, Atlantic Coast Line, Wilmington, N. C.; W. E. Sample, assistant superintendent fuel conservation, Baltimore & Ohio, Baltimore, Md.; E. G. Sanders, fuel conservation engineer, Atchison, Topeka & Santa Fe, Topeka, Kan., and Glenn Warner, fuel supervisor, Pere Marquette, Detroit, Mich.

Report on Utilization of Locomotives

During the years that full conventions have not been held, your committee has continuously been studying the utilization of all types of locomotives and has given, from year to year, in your regular yearly bound proceedings, the outstanding performances and ways and means of obtaining greater utilization.

The committee finds a difference of opinion as to the cost of maintenance per mile of high vs. lower utilization, and it seems possibly very beneficial that this situation has developed because if utilization is only some mileage figures which we can brag about and does not decrease cost, it is an academic picture and in these busy days of railroading, perhaps would not demand much of our attention, but if high utilization means a definite and material reduction in the cost of maintenance, it, under present conditions requires our most careful study.

From the accompanying tables it will be noted that the average miles per day for passenger engines has increased from 195 for 1941 to 227, a 16 percent increase.

In freight, we find an increase from 116 to 118 miles a day, not quite 2 percent, while in switching we find an increase from 77 to 81 miles per day, an improvement of a little over 5 percent.

Study of the effect on repair cost recommended—Methods to increase use of power outlined

(Undoubtedly the number of Diesels put in service has had at least some influence on this picture.)

A study of the prompt handling of locomotives at terminals, based on the experience of many different railroads, was made by the committee. This study indicated that one of the most important factors in locomotive utilization is the planned maintenance of locomotives, which includes planned movement through terminals. This is the keystone of the whole program of utilization, and some roads have accomplished it as follows:

Immediate inspection when the engineman gets off of the locomotive. Some of these engines go into the enginehouse after the inspection, because of certain work, such as train-control checks, which cannot be effectively handled with the outside inspection facilities. Other places, of course, have complete lubrication

Railway Fuel and Traveling Engineers' Association

Officers

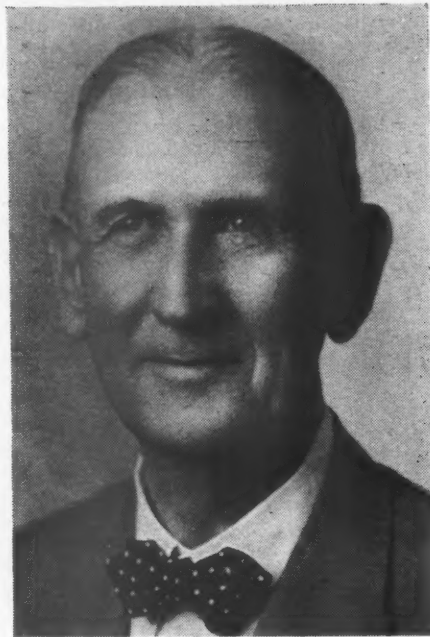
1945-46

President: *L. E. Dix, acting mechanical superintendent, Texas & Pacific, Dallas, Tex.*

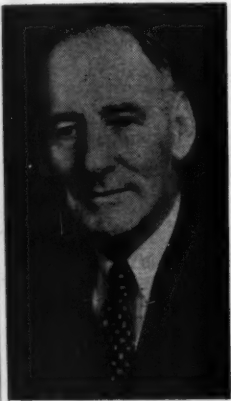
Vice-President: *W. C. Shove, general road foreman engines, New York, New Haven & Hartford, New Haven, Conn.*

Vice-President: *W. R. Sugg, general supervisor air brakes, Missouri Pacific, St. Louis, Mo.*

Secretary-Treasurer: *T. Duff Smith, 327 South La Salle Street, Chicago.*



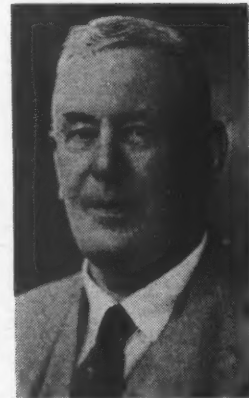
L. E. Dix



W. C. Shove



W. R. Sugg



T. Duff Smith

sheds, while other terminals have elaborate outside inspection plants, where all necessary work is taken care of on a large percentage of the locomotives, the ones going into the house being only those requiring washouts, reconditioning or some heavy repairs—about 25 per cent.

One terminal reports that this terminal handling has been greatly facilitated by a complete means of inter-communication with all points, including loud speakers in some places, and particularly a telephone on the turntable.

Interchangeable Parts

Several railroads reported that they had improved utilization materially by the following:

Keeping extra assemblies of roller bearings for main or all drivers. In the event of a defect, the extra wheels could be applied immediately, and the engine returned to service more quickly.

Most roads reported extra roller-bearing engine-truck, trailer and tender wheels, at least at central points, for all classes of locomotives.

Other roads reported that their knuckle pin and rod maintenance had been materially improved by using ground steel and case-hardened knuckle pins. Such knuckle pins are reported eliminating roundhouse work because this type of bushing, with proper care, will last between shoppings.

Where multiple-bearing crossheads are used, some lines have spare assemblies of crossheads, piston rods and pistons on hand. Where crossheads need renewing due to excessive wear, the spare part may be put in without delaying the locomotive.

Diesel Passenger Performance

The question was asked of one road having a large number of Diesel passenger engines in operation for some time as to what maximum miles they anticipated they should make per month. They say that that depends entirely on the business available, that one group of their engines can make 24,000 per month, while on some other schedules it is possible only to make 14,000.

One road with 22 double Diesel units reports an average overall mileage of 19,734 per month.

Unfortunately trains run in fleets and that means idle time. One road with electric passenger and freight power reports mileage comparable with steam.

Quality of Coal

The quality of coal is a controlling factor in the utilization of locomotives because slagged flue sheets, plugged flues, etc. with the type of coal now obtainable, tie up engines much more frequently than in previous years. The present coal quality is, of course, due to the excessive demand for coal, and the necessary

purchases from the smaller mines that do not have adequate cleaning facilities.

Maintenance Costs

In discussing this matter with the editors of one of our leading railroad trade papers, the thought was expressed that utilization of locomotives was a high sounding phrase and nice to be able to



A. A. Raymond,
Chairman

boast about if you have it, but possibly if you didn't have high utilization, it might be an incident to discuss but nothing to be worried about too much, unless it materially affected cost. That is, low mileage might be an unfortunate happening but not harmful, unless, as Mr. Kettering of General Motors says, it "leads by the cash register". (Every study, he said, is an academic investigation unless it leads by the cash register.)

In checking opinions of the cost per mile, the following have been developed:

For high utilization engines must be in better condition, which is cheaper than hand-to-mouth maintenance that generally accompanies short runs.

Higher utilization means better engines and therefore a higher repair cost.

Miles per Active Locomotive per Day on the 13 Largest Systems—1945

	Passenger	Freight	Switch
A. T. & S. F. System.....	370.0	147.8	96.7
A. C. L.	239.6	93.5	60.1
B. & O.	245.1	114.9	87.0
C. & N. W.	208.4	111.0	67.4
C. B. & Q.	248.9	118.2	80.3
C. M. St. P. & P.	252.8	118.6	82.2
C. R. I. & P. (inc. C. R. I. & G.)..	302.0	116.2	92.1
L. C. (inc. Y. & M. V.) ..	166.1	89.6	52.5
N. Y. C. system (inc. B. & A.) ..	226.7	129.2	86.6
Pennsylvania	235.8	100.4	84.6
Southern	208.0	121.5	65.8
Southern Pacific	287.7	130.7	104.4
U. P. system	323.8	146.7	90.7
Districts:			
Eastern	206.8	110.4	84.8
Pocahontas	204.5	104.8	81.1
Southern	201.2	114.6	66.8
Western	263.2	128.9	84.2
Total United States	227.0	118.5	81.9

Miles per Active Locomotive per Day on the 13 Largest Systems—June, 1946

	Passenger	Freight	Switch
A. T. & S. F. System.....	338.1	154.5	96.6
A. C. L.	227.1	94.8	62.3
B. & O.	239.4	114.2	83.7
C. & N. W.	210.2	104.8	68.9
C. B. & Q.	238.0	109.4	76.6
C. M. St. P. & P.	251.1	116.4	80.9
C. R. I. & P. (inc. C. R. I. & G.)..	253.5	134.5	89.2
L. C. system	156.1	89.7	51.1
N. Y. C. system (inc. B. & A.) ..	230.6	133.4	89.1
Pennsylvania	221.2	105.5	86.7
Southern	177.3	123.8	67.3
Southern Pacific	308.2	139.9	108.4
U. P. system	339.5	143.2	91.4
Districts:			
Eastern	202.3	111.3	85.3
Pocahontas	210.7	115.3	84.0
Southern	185.2	113.6	67.5
Western	257.0	126.8	82.5
Total United States	220.6	118.2	81.7

Results of a Study of the Effect of Utilization on Shop Repair Costs

Monthly mileage	CLASS A	Average cost, cents per loco. mile
2000-3000		17.91
3000-4000		17.89
4000-5000		17.21
2000-3000	CLASS B	12.72
3000-4000		12.24
1000-2000	CLASS C	10.84
2000-3900		10.41
5000-6000	CLASS D	10.81
6000-7000		11.65
7000-8000		11.05
Over 8000		10.67
5000 and under 6000	CLASS E	11.71

An engine, standing in the enginehouse half of the time is not wearing herself out, so should cost less to maintain.

A conception of high monthly mileage per locomotive might be compared to the principle on which the 5-and-10 cent store idea is based. They invest a dollar in merchandise and turn that dollar over eight or ten times a year, making a small profit on each turnover, hence a profit which may be only 1 per cent per turnover, in their final summary for the year means 8 or 10 per cent.

The same thing would seem to apply for back-shop repair costs. —\$5,000, \$6,000 or \$7,000 is invested in a locomotive during back shopping and the sooner this mileage, which is built back into the locomotive during the shopping, is run off, the sooner you realize on the back shopping investment. For instance, if the back shopping cost per mile equalled the day-to-day maintenance cost per mile, doubling the mileage of the locomotive per mile of time would realize on the back shopping cost in half the time which formally existed.

One large railroad says that the indirect expense at the roundhouse is fixed. At a roundhouse point where a group of locomotives is maintained, an increase in the monthly mileage would result in a decreased cost per mile for over-head, and inspection will be reduced in proportion to the increase in locomotive miles. However, they warn that when business is constant, if miles per unit are to be increased, it is essential that the amount of surplus power be accurately determined and that that be stored. One railroad reports that engines making 7,400 miles per month cost 20 cents per mile for maintenance, while other engines making 6,700 miles, cost 30 cents — both in passenger service.

Another railroad reports shopping costs of engines making 91,000 miles a year, as 12½ cents, while engines making 83,000 miles a year costs 13 3/10 cents. Another road brings out a very interesting comparison. They had some Mallet locomotives costing about 38 cents a mile, which, after complete modernization was reduced to 20 cents a mile. This modernization permitted a 33 per cent increase in utilization, but the particular item of interest was that their previous cost had been \$2.98 per million tractive power pound miles, while after modernization, it was \$1.59 per million tractive power pound miles, a reduction of 46½ per cent.

One road studied classes of power of equal age and mileage through to at least a complete firebox renewal. War years were not included, and each class was studied independently. A careful study indicated that running repairs had not increased in the period. The road says that possibly the above figures do not justify a definite claim that high mileage means reduced cost, but it feels that within logical limits utilization does reduce shop maintenance on a mileage basis.

Summary

In these days of very high wage and material costs and serious lack of earning power equal to the cost of operation, your committee suggests:

- (1)—That careful studies be made of the maintenance cost of locomotives with high vs. low utilization, to determine the actual comparative costs, if such costs are not available or reliable.
- (2)—That, after higher utilization is obtained, the profits are assured only as the surplus power is taken out of the active list.

(3)—That the more intensive use of the existing 38,000 coal-burning locomotives can be obtained by little, if any, relative capital investment.

(4)—That recent substantial increases in the cost of coal makes cost studies imperative.

The members of the committee are A. A. Raymond, chairman, smpt. fuel and loco. performance, New York Central System;

E. G. Sanders, fuel conservation engineer, Atchison Topeka & Santa Fe; J. E. Londry, general road foreman of engines, Chicago, Rock Island & Pacific; R. G. Bogle, fuel engineer, Southern Pacific Co.; H. L. Ferguson, general fuel supervisor, Union Pacific; M. J. Donovan, mechanical engineer, Lima Locomotive Works, and J. E. Long, general sales manager, Franklin Railway Supply Co.

The Coal Situation, Now and Future

Fuels of more uniform quality from the mines, better handling and efficient use by the roads a basis for future cooperation

Competition is something we really have now—and I say “we” advisedly because you appreciate the interdependence of coal and the railroads. We have been going forward for years under the happy delusion that we had a perpetual monopoly. There was nothing to compete with the iron horse. It is true we saw automobiles take the place of Old Dobbin and the automobile manufacturers put the old carriage builders out of business. We thought, “That can’t happen to us.” But, it has. That means that every one of us in the coal business, the railroad business, the railroad supply business, and particularly in the traffic departments of the railroads, must realize that if we want the railroads to continue to be the coal companies’ best customers—if the coal companies want the railroads to continue to be their best customers—we must make the steam coal-burning locomotive more efficient or it can’t compete with power derived from other fuels.

That can be done if we will forget many of our old fangled ideas and start fresh. First of all, I, as a coal man, have to quit crying on the shoulders of my railroad friends and telling them I am “awfully sorry but my plant broke down. My regular customers won’t take unprepared mine run. Won’t you please help me out with a hundred cars for a few days?”

Traffic and the railroad purchasing agents will have to quit saying, “Yes, I will, as a personal favor.” Steam locomotives should have the kind of fuel they need to do a job. The traffic fellows must stop bedeviling purchasing agents to please favor Tom Jones because he is a friend and he knows how to get a whole boatload of bananas shipped over their railroad if they will just buy some coal from him. That is bunk when you are trying to produce cheap ton miles.

I don’t know whether this story is true or not, but I heard that one railroad president not long ago said he was buying some Diesel locomotives. He didn’t want to buy Diesels, but he needed locomotives and he could get delivery of Diesels in three months and he couldn’t get the specifications for steam locomotives through his own mechanical department in three months. Let alone getting them built.

The Diesel locomotive is much like the automobile. You go in a show room, select your paint job and either buy it or not. If you say, “Please change this and this and that,” they say, “We don’t want your business; thank you. . . . This is our standard product.” When once I tried to get special brakes put on an automobile I was told, “If you don’t like our automobile as it stands on the floor, buy somewhere else. We think this is what you need. That is our business.”

There has been too much tailor-making of the steam locomotive. We must standardize, because wherever standardization has been practiced everybody has been better off.

Coal mining, at least bituminous coal mining, is a railroading proposition. Years ago, I sat on a committee of the American Mining Congress on standardizing mine tracks. Every manufacturer set his own standards, every coal-mine operator had his own idea of how tracks should be laid. As a result, manufacturers could not stock frogs or switches. They had to tailor-make them, and they cost more. The coal operator couldn’t get what he wanted promptly because of special requirements. He crabbed because of slow delivery, and he paid a big price. Stand-



By R. L. Ireland, Jr.,
President, Hanna Coal Company

ardization has cured that. The manufacturer doesn’t need so many patterns and he can afford to stock standard material and have it ready for delivery to the customer when he wants it.

Fuel-oil refiners have an advantage over us. They can take crude oil, split it up into component parts and they can warehouse the component parts without having it disintegrate or without too great a cost of taking it off the shelf later on.

One of the problems, and one of the excuses, so far as coal is concerned is that when we bring out mine run and size it, the only place we can store it without having it break up into smaller pieces, is in railroad cars. You can’t store much coal in railroad cars, so in the coal business, we have to balance our sizes. If we want a certain size of coal, we have to find a market for all the other sizes that make the composite picture. That is why, in the past, railroads have been our best customers. They could use any size and Heaven knows we gave them any size.

The efficiency of a steam locomotive is relatively low as compared to stationary plants. Therefore five per cent more ash in railroad fuel didn’t do nearly the damage it would in a more efficient plant. So, we didn’t worry much about it as long as we could get away with it. The railroad superintendent of locomotive performance tore his hair, but, after all, you could laugh at him because he hadn’t been able to get a properly constructed coal dock. The coal would all go into the same dock with a chute on each side. The slack would go over to one side and lump to the other. The switch engine would get the lump and the road engine the slack. I wasn’t too sympathetic when they talked about size to me after that. I have ridden locomotives and I have seen some of the firing practices and so could tell the purchasing agent of the railroad, “Until you correct some of the faults at home, don’t talk to me. Our coal is plenty good if you just give it reasonable treatment.”

But, those days are over. We, as coal men, have competed for your fuel business and now we have to compete with fuel oil and with Diesel locomotives. I don’t believe for a moment that a Diesel locomotive is ever going to be able to pull a train of cars over the road as cheaply as a properly constructed, properly operated, properly fueled coal-burning steam locomotive or coal-burning locomotive in any case.

One of the problems that the coal men have is the ever-chang-

ing railroad specifications. Another one is the fluctuating demand for our product. The railroads could be helpful to us if they could settle upon their specifications, and their daily requirements. Given time to figure it out, we can give the railroads any size and any quantity that they need. And, we have some know-how that we could contribute.

Arriving at the proper size and the proper ash content for a job, is just like whiskey—you can buy cheap whiskey with a good headache for very little money. Or, you can pay more money and get good whiskey and you have more fun and less headache. You can buy 80 proof whiskey or 120 proof whiskey, and the 120 proof whiskey costs you more money but it does the job faster.

Now, somewhere, there is a brand of whiskey that suits an individual, or a crowd of good fellows, and somewhere there is a set of specifications on coal that will do an excellent job on railroad locomotives. But is it fair, proper, or reasonable, to ask us to make a $\frac{3}{8}$ -in. by $1\frac{3}{4}$ -in. size of coal and then take it up in the air and drop it down into an empty coal dock, throw it into a tank of a locomotive, grind it all to smithereens with the screw of the stoker, and then not even use the stoker properly but build up a big clinker in the back of the firebox and let the engineman blow the fire off the front end of the grate?

Frank Cooperation Essential

We need cooperation and we would like to have our customer go half-way on this new step forward. Let's march arm in arm, but don't send us out ahead of the parade. We will be in the

front ranks, but we want you fellows with us.

We all have a terrific job in this country. The Army and the Navy won the war and now our diplomats with all their conversations are losing the peace for us. That's the way it looks by reading the newspapers. Let's not be guilty of that same practice. We have the know-how in our respective organizations to lick these problems if we just don't let the diplomats in our respective organizations talk us out of it. Let's cooperate by putting our brains together in the development of coal handling and coal burning. From there on, my job is done. to convert that steam into power on the wheels is a job for some of the rest of you. Let's get started and let's quit standing still. Let's really move.

About six months ago at a National Coal Association meeting a bunch of fuddy-duddies were crying about Diesel locomotive. I said, "It is your fault—you haven't done your part—you should stop selling cats and dogs to the railroads and treat them as real consumers."

When we sell fuel and turn it over to a public utility, they get the last squeak out of it. They handle it properly all the way through. From personal knowledge, I know that is not true of the railroads. They have not done nearly the job of using our fuel as have other customers. They don't get the meat out of the cocoanut. They blow it up the stack. They throw it out the right of way. They do everything but turn it into steam.

So, gentlemen, speaking for the coal industry, we ask you to forget the past. Please wake up. Please, by concerted action use our coal more efficiently. We would much rather sell you half as much coal as we are now selling you at a good price than have to quit selling you at all.

Locomotive Operation on the Burlington



By H. H. Urbach,

Mechanical Assistant to the Vice-President, C. B. & Q.

On the Burlington we have a Road Foremen's & Fuel Association headed up by our general road foreman of engines and by our air-brake instructor. These men have meetings with all of the traveling engineers several times a year. Their discussions involve fuel conservation, proper train handling, train delays and instruction to enginemen. They also make recommendations for improvements to locomotives.

Steam Locomotive Operation

On the Burlington Lines we now have in service about 800 steam locomotives, which make somewhat less than two and one-half million locomotive miles per month. For the most part these locomotives are modern in every respect, although many are older types that have been modernized progressively through the years. Until a few months ago, usage of our modern power was

System of assignment and maintenance of steam and Diesel power—Diesel shop facilities described

intensive, operating on long locomotive runs and accumulating high yearly mileages.

This power is assigned to divisions under the direct jurisdiction of master mechanics and road foremen of engines, who are responsible for its maintenance. For many years we have maintained a permanent power committee, consisting of representatives from all interested departments, which meets periodically to discuss and formulate policies to be followed with respect to the assignment of power and other pertinent subjects pertaining to power.

This committee works to the end of assigning power to divisions and districts where it will be utilized to the fullest possible extent, keeping in mind the segregation of power to simplify material and maintenance problems.

I have always believed that the greatest utilization, best performance and most economical maintenance can be obtained from locomotives that receive their principal maintenance at a headquarters terminal; therefore, our policy has been to maintain at least one and, in some cases two, large heavy repair terminals on each master mechanic's district. Following this policy a master mechanic can keep in very close touch with the condition and performance of his power. Locomotives given proper maintenance attention at a large headquarters terminal where facilities and men are available will require very little attention at outside or intermediate terminals, thereby reducing delays in power at such terminals.

On our railroad we burn various types of coal—averaging from about 9,000 to 12,000 Btu. This condition results in steam problems because a locomotive traveling over one or more districts is frequently supplied with more than one kind of coal. Naturally the locomotive must be drafted for the poorest coal. Some of the coal is a sub-bituminous or lignite, which throws considerable fire out of the stack and ashpan; therefore, to make operation more flexible, we have developed a front end that

permits the burning of either sub-bituminous or lignite coal as well as straight bituminous coal with a minimum of fire hazard. Practically all of our coal-burning locomotives are equipped with table round-hole grates. Oil-burning locomotives are operated on our western and southern lines.

Very little difficulty is experienced because of water conditions, as we are well equipped with modern water treating facilities and large water cranes.

Diesel Locomotive Operation

The Burlington Lines now operate the following Diesel-electric locomotives: 23 passenger, 1,800 to 4,000 hp.; 21 freight, 4,050 and 5,400 hp., and 120 switching locomotives of 360 to 1,000 hp. These Diesels comprise 17 per cent of our total power, and make over a million miles per month, or 35 per cent of our total locomotive mileage.

The average availability of our Diesel passenger locomotives is 95 per cent. The Diesel freight locomotives are available 86.7 per cent of the total time, and the switchers 96.7 of the total time.

We now have Diesel passenger locomotives handling all of our streamline trains on the Chicago-Denver, Chicago-St. Paul and Denver-Dallas runs as well as practically all of the conventional main-line trains between Chicago and Denver. This power averages approximately 20,000 miles per locomotive per month. The entire maintenance of this power, except the Denver-Dallas assignment, is handled at the Chicago terminal, with only such emergency repairs made at the away-from-home terminals as are necessary to insure good performance. The performance of this class of power on main-line passenger trains has been very satisfactory, the locomotives running through from Chicago to Denver, Chicago to St. Paul, and Denver to Ft. Worth. Enroute servicing attention is practically nil, which results in better on-time performance than was formerly possible with steam power, which required coal, water and other heavy servicing attention enroute.

Diesel freight power is assigned to handling time-freight trains between Chicago-St. Paul, Chicago-Kansas City, Chicago-Denver and Lincoln-Sheridan. This power averages approximately 14,000 miles per locomotive per month. The Chicago to St. Paul power is maintained in our Chicago (Clyde) terminal with only sufficient turn-around time at St. Paul for necessary servicing attention. Freight power operating between Chicago and Denver runs to Denver on assigned time-freight trains, then back to Lincoln, Neb., from which point a trip to Sheridan, Wyo., and return is made. The engine is then placed on a main-line freight train to Chicago, where it receives major running maintenance at our Chicago terminal. Freight power operating to Kansas City runs through from Chicago to Kansas City and on the return trip makes a trip from Galesburg to Savannah and return—thence Galesburg to Pacific Junction and return to Chicago where all heavy running repairs are performed.

Regular mileage schedules are set up for freight, passenger and switching Diesel power for the inspection of pistons, connecting-rod bearings, changing of oil, traction motors and traction-motor servicing attention.

All of our important switching terminals have now been equipped with 600-, 900- or 1000-hp. Diesel locomotives, which, as far as possible, are assigned to around-the-clock switching tricks. This has greatly reduced yard delays for servicing, as compared with steam power, and has brought about a substantial reduction in the number of switch tricks assigned.

To maintain our Diesel locomotives properly it has been necessary to install suitable facilities. At our Chicago (Clyde) terminal a new Diesel shop recently completed has the facilities for changing trucks, wheels, and traction motors, for heavy maintenance of Diesel engines, and repairs to electrical equipment. Sufficient machine tools have been installed so that this work can be carried on expeditiously, insuring maximum availability of power.

Passenger locomotives are maintained in our Fourteenth street passenger yard, Chicago, where a drop pit and other facilities have been installed.

Part of our main locomotive shop at West Burlington, Iowa, has been converted to handle our heavy Diesel locomotive repairs. One large bay of this shop has been set aside and equipped with modern machinery particularly adapted for heavy repairs to

Diesel engines, truck and wheel work, and for repairing and rebuilding electrical equipment. In this shop Diesel engines are removed from locomotives and completely torn down for crankshaft grinding, crankcase repairs, overhauling of pistons, liners, heads, injectors, governors, etc.

This shop is also equipped with an electrical department to handle rewinding and rebuilding of armatures and other electrical equipment. It has been so laid out that the rebuilding and overhauling of Diesel engines, electrical equipment, truck and wheel work is performed on a progressive basis.

At the Denver end of our line, a three-stall Diesel shop has been built to handle light running repairs.

At the West Burlington shop a sufficient number of the various types of Diesel engines are held ready for application to either freight, passenger or switch power. The engine needing repairs is removed and a good engine installed. This requires about 24 hours in most cases, and avoids holding the locomotive at the shop while the Diesel engine is being repaired.

The Clyde and Denver terminals are also equipped with extra trucks, wheels and traction motors so that trucks, wheels and traction motors can be maintained currently. Perhaps the greatest advantage of Diesel over steam power, is that Diesel power can be maintained almost currently in every respect, thereby avoiding extensive shop days to maintain them.

The maintenance of Diesel switching power is more simple than that of either passenger or freight Diesels. Lesser facilities are required, and, because of the low mileage made, repairs are spread over a longer period of time. Most of the switching power on our railroad is withdrawn from service one day in a 30-day period for general checking and inspection. The running inspection and light maintenance is taken care of while crews are taking their lunch periods.

The period ahead of us is going to present many problems and opportunities for progressive railroading. I am confident that a large measure of the railroads' success in whipping these problems and grasping new opportunities as they arise will be attributable to the resourcefulness and ingenuity of our traveling engineers.

Eliminating Black Smoke

A report on how black smoke can be eliminated was prepared during 1945.* The report was based on the experience of the Richmond, Fredericksburg & Potomac in improving smoke conditions, practically eliminating smoke from locomotive stacks by the adoption of the overfire induction tubes. The changes in the locomotives recorded in the report included the replacing of open arches with sealed arches, lowering the inside stack



G. B. Curtis,
Chairman

extension and employing a spreader type nozzle. These changes reduced smoke to a minimum when the engine was working but did not remove the difficulty of keeping down smoke while the locomotive was standing.

*See page 504 of the November, 1945, *Railway Mechanical Engineer*.

After the overfire induction tubes had been installed, interlocking the jets with the stoker overcame the effect of the reluctance of the engine crews to use the jets. Arrangements have also been made for the operation of the steam-air jets from the house blower which is of material benefit in firing up engines.

In the case of old engines equipped with overfire induction tubes, they can be fired with a No. 1 or less smoke by employing the horseshoe bank; that is, firing heavier around the sides and back sheet with a light fire in the center and front of the firebox.

Discussion

In firing with the horseshoe bank, it was pointed out that with the large amount of coal which can be stored in the bank the fireman had better not try to shake it, as he is likely to mix the fuel, ash and fresh coal in a way to start clinkering. With respect to the opening of the fire door to prevent smoke, one discussor advised that it be kept closed when there is a hot fire as opening it under such conditions will produce smoke, whereas with a dull-red fire it should be opened to abate smoke.

Roy V. Wright, editor, *Railway Mechanical Engineer*, called attention to the important public relations aspect of smoke elimi-

nation. He recited a number of evidences of a growing aesthetic consciousness on the part of the general public which has come about with the improvements in living conditions on which there have been steady gains over the years. This, he said, had made the public both noise and dirt conscious and the problem of smoke elimination has expanded from certain city areas to take in practically the entire countryside. Failure to recognize this fact and to act upon it, he said, would jeopardize the public relations of the railways.

In closing, the chairman said that it was unnecessary to interlock the stoker with the overfire jets. He emphasized the importance of undertaking to sell the engineman on the need of smoke elimination, developing in them a will to cooperate in eliminating smoke.

The committee consists of G. B. Curtis, road foreman of engines, Richmond, Fredericksburg & Potomac; B. B. Sweeney, road foreman of engines, Atlantic Coast Line; J. A. Sturdivant, road foreman of engines, Atlantic Coast Line; W. C. Shove, general road foreman of engines, New York, New Haven & Hartford; J. D. Clark, fuel supervisor, Chesapeake & Ohio; H. E. Painter, fuel instructor, Chesapeake & Ohio, and E. D. Benton, fuel engineer, Louisville & Nashville.

The Road Foreman and Diesel Locomotives

This year's committee report, though to a large extent a revision of that published last year*, contains several important additions.

Clean fuel oil was defined as oil that has been properly filtered and free of water and abrasives. Abrasives cause wear on the fuel pump, reduced efficiency, a lowering of the volume of fuel delivered, and wear and scoring of the injection equipment. Water in the fuel results in sludging and stoppage of



W. D. Quarles, Chairman

the suction filter, and may damage or destroy the fuel-pump seals.

To have clean fuel, care must begin at the various fueling stations along the railroad. Each plant should have a Wastex-packed filter in the line between the tank car and the storage tank, and between the storage tank and the locomotive fuel hose. Storage tanks should be equipped with drains for periodic removal of condensation.

The major portion of failures caused by the scoring of crank shafts, liners, pistons, and other parts is considered to be attributable to one of the following forms of improper maintenance or operation:

1.—Failure to clean and flush properly the lube oil system at stated intervals, or after the presence of water, metal and excessive sludge.

2.—Operating with the oil pressure too low.

* See *Railway Mechanical Engineer* for November, 1945, page 498.

System for determining condition of the lubricating oil outlined—The importance of filtering fuel oil and lubricating oil stressed

3.—The lubricant being washed from the piston assembly by water or a fuel oil leak.

4.—An unbalanced loading resulting from improper linkage adjustment.

5.—Incorrect injector timing, causing noisy and dirty engine operation.

6.—Failure to handle oil in clean containers.

7.—Operating the engine with either high or low water-jacket temperature. High temperature causes oxidation of the oil, and low temperature causes water and the products of combustion to wash the lubricant from contact surfaces, resulting in wear at three times the normal rate.

8.—Excessive idling at low jacket temperature. The engine should not be shut down after idling without increasing the speed for a moment; otherwise varnish may form and set permanently.

9.—The use of reclaimed oil in incorrect proportions.

Filters should allow uniform passage of oil and be packed with material that removes the blow-by carbon. There is no definite relation between the condition of the oil and the locomotive mileage if the oil is properly filtered. Changes can be determined by the condition of the oil and the system. At assigned maintenance terminals the following work should be done after each trip, or day's work, on road locomotives, and weekly on switch locomotives:

(a)—Make a viscosity test for dilution, using a visgage record viscosity on an oil spot-test blotter. If diluted to the condemning limit, change the oil, determine the cause of dilution and correct the condition.

(b)—Make a visual inspection of the oil with the engine running or immediately after it is shut down to detect the presence of water, metal or other contamination. If contamination exists, the oil should be changed and the cause of contamination determined and corrected.

(c)—With the engine running, or immediately after it is shut down, test the oil for free carbon content by placing a drop on the special white blotter provided for this purpose. Lubricating oil which causes abnormal discoloration of the spot test blotter indicates improper filtering.

The most common causes of blow-by free carbon are:

- 1.—The filter removal period is too long. If the outer surface of the waste is coated with heavy black sludge, a piston is cracked or the rings are stuck.
- 2.—The filter is improperly packed. Waste should be uniform in shape from top to bottom, and uniformly dark from the outside to the core.
- 3.—If a by-pass valve is stuck open the oil will be black but the filter element will not.
- 4.—Filtering not taking place as a result of improper application of the filter element.
- 5.—Damaged center tubes will be indicated by excessive lint in the oil.

When a detergent-type oil is to be used in an engine formerly lubricated with regulator oil, the engine must be thoroughly cleaned before adding the new oil.

Maintenance of the correct engine temperature has always been a problem of the Diesel locomotive industry. Research engineers have long recognized the definite relationship between engine temperature and engine efficiency. However, it has

been only in recent years that they began to stress the importance of maintaining constant cooling-water temperature to keep the engine and its lubrication system at peak operating performance, instead of merely keeping it within safe operating limits. Conclusive tests have demonstrated that accurately controlled engine temperature pays off not only in better engine performance but also in increased engine life with a marked reduction in cracked cylinder heads, pistons and liners which were caused by expansion and contraction. Constant engine temperature improves lubrication, decreases water condensation and acid formation in cylinders, and improves combustion.

In checking circulation, the engine water-tank thermometer provides an excellent means of detecting irregularities. The engine high-temperature switch connects with two thermal elements, one in each water outlet manifold of the engine. If the temperature exceeds 200 deg. a switch closes. This operates a signal relay which lights the hot-engine light and sounds the alarm bell. Further aids in preventing damaging variations in engine temperature are periodic flushings of the cooling systems and reliable automatic shutter control.

Diesel Locomotives to Fit the Job



By O. L. Olsen,

Regional Service Manager, Electro-Motive Division,
General Motors Corporation

Many steam types from 4-6-4 to 2-8-8-0 are matched by a single Diesel with varied gear ratios

was designed, would be about equivalent to the two-unit Diesel-electric locomotive previously mentioned, when that locomotive is equipped with a final drive including a 12-tooth pinion on the traction motor.

The second comparison will be what is commonly known as the 2-10-2 type, with ten driving wheels all coupled together to one pair of cylinders and having slightly less tractive effort than the articulated locomotive mentioned in the first example. This locomotive can be operated at somewhat higher speeds than the Mallet and does heavy hauling on railroads in the United States. Its performance in service for which it was designed is equivalent to that of the two unit Diesel-electric locomotive equipped with a 15-tooth pinion on the traction-motor shaft.

Next we have a 2-8-4 type locomotive which is intended for lighter freight trains than the 2-10-2 type is capable of handling and with operation at somewhat higher speeds. This locomotive is usually equipped with larger diameter wheels than the 2-10-2 type, and its performance would be equivalent to the two-unit Diesel-electric locomotive equipped with a 16-tooth pinion on the motor shafts.

Our next comparison will be with two types of 4-8-2 locomotives. This type may be used in fast freight or heavy passenger service, particularly where heavy grade conditions prevail. If we select a representative locomotive of this group which has a smaller diameter driving wheel, its performance would be equivalent to that of the same two-unit Diesel-electric equipped with 17-tooth pinions on the traction motor shafts, and its correspondingly smaller axle gear. If we make the comparison with a higher-wheeled locomotive of the type which is generally used in prairie country, we find its performance is equivalent to the two-unit Diesel equipped with an 18-tooth pinion on the traction motor.

Now we come to the so-called combination locomotive, the well known 4-8-4, for heavy passenger and fast freight work in which quite high scheduled speeds are required. This is the popular steam locomotive of today. Its performance would be equivalent to that of the two-unit Diesel-electric locomotive with a 19-tooth pinion on the traction motor, and last but not least, we have the 4-6-4, which started out to be the last word in fast passenger locomotives. It was very popular a few years ago, and is still widely used, but the Diesel locomotive has replaced it on the fastest passenger schedules. Its performance is equivalent to the same two-unit Diesel with a 20-tooth pinion on the traction motor.

One Diesel locomotive outwardly appears the same as another of the same manufacture. Yet, there may be as much difference between them as between Pacific type and Santa Fe type steam locomotives. The contrast between the latter is at once obvious, and readily recognized by any person who professes some knowledge of American railroading.

A Diesel locomotive may appear the same as the one standing on the next track, and yet may be suited to an entirely different class of service. This apparent paradox is due to its adaptability through gear ratios. Steam locomotives having the same fire box and boiler capacity are the same size. They may be, however, intended for quite different purposes, and therefore show considerable difference in type, appearance, and ability to perform.

We will use for comparison, a two-unit Diesel-electric locomotive similar to our current model freight locomotive. It is powered by two 16-cylinder Diesel engines. After this locomotive is 95 per cent complete it is possible to change the gear ratio between the traction motors and the driving axles, and possible to install either dynamic braking or train heating boilers; in some cases both are used.

Along with this, if we make a mental picture of seven different types of steam locomotives, the first being a Mallet articulated of 2-8-8-0 wheel arrangement, we are ready to make our comparisons. This type of locomotive is intended for slow-speed, heavy hauling, particularly in mountain country. The performance of this locomotive, if used in the service for which it

The wide variation in type, which makes the building of steam locomotives a strictly tailoring business, but modern manufacturing methods can be introduced into the building of Diesel-electric locomotives without imposing on the railroads any limitations in flexibility of motive-power application. An advantage which the user of the Diesel-electric locomotive has is that Diesel-electric locomotives can be purchased for one class of service and then by a change of gear ratio adapted to another class of service without the expenditure of any great sum of money. His adaptability is entirely absent in steam locomotives without complete re-building. Another comparison which reacts favorably with our customers is that most of the spare and replacement parts for many types of locomotives are identical in the case of the Diesel-electric locomotive, and the variety of steam engine construction has made spare parts for any particular engine an adventure in itself. Ask any roundhouse foreman.

The "Streamliners"

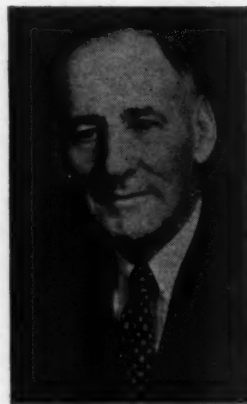
We now come to fast passenger locomotives. We have produced a number of Diesel-electric locomotives which have no counterpart in steam, but since these locomotives were the ones most instrumental in converting the railroads to the use of Diesel-electric locomotives, they warrant some discussion. We therefore pass on to our high speed passenger locomotive, best known as the "Streamliner." Ten or twelve years ago an increase in scheduled speed of some passenger trains became absolutely necessary if the railroads were to avoid the loss of most of their passenger traffic, and the introduction of these high-speed trains brought up many problems, both in the construction of the passenger cars themselves, and in the type of motive power to be used to haul them. The problems of car construction were ably handled by the various well known car builders, as well as some of the railroads themselves, and lightweight, strong and comfortable cars for high-speed operation were produced.

Two types of locomotives were developed along with the cars. One mid-western railroad developed a 4-4-2 type steam locomotive to pull a fast new train. This locomotive was a modification of what was the high-speed passenger engine of 40 or 50 years ago. The chief virtue of this type of locomotive in high-speed work lies in the fact that there are only two pairs of driving wheels, consequently only two connecting rods, and the mechanical balance of their running gear is not nearly so difficult as in the larger and more complicated locomotive structures of modern time. This locomotive was quite capable of handling the short, lightweight train which inaugurated high-speed service on that road, and except for the higher maintenance cost due to high speed, was quite successful. Other railroads cooperated with the Electro-Motive Division in the development of a Diesel-electric locomotive which would be an equivalent to this locomotive. This was our 2,000-hp. "Streamliner" model powered by two 12-cylinder Diesel engines and carried on two six-wheel trucks, the long wheel base and six wheels promoting smoother riding qualities and stable operation at extremely high speeds. These two locomotives, one steam and the other Diesel-electric, were remarkably alike in performance ability, but economy of operation, both in regard to fuel consumption and cost of maintenance favored the Diesel-electric.

Passenger response to the high-speed trains was immediate and the traffic on all the high-speed trains quickly became so great that longer trains became necessary and therefore more power was needed in the locomotive. The 4-4-2 steam locomotive was incapable of development into larger sizes, and the steam-minded high-speed train operators turned to the 4-6-4 type for power. The Diesel-operated train problem was very simple. We simply added a second unit to the Diesel-electric locomotive and produced the 4,000-hp. "Streamliner" or high-speed passenger locomotive. Performance of the 4-6-4 type locomotive at extremely high speeds was not too satisfactory, the principal trouble being due to the fact that the third set of driving wheels so increased the weight of the reciprocating parts that balancing problems became rather acute. As a result of the foregoing, there has been an increasing tendency on the part of the railroads to turn to this type of Diesel-electric locomotive to solve their problems in handling the higher-speed passenger trains. While the locomotive has its limitations, it will probably continue to be very popular for the ultra high-speed trains for which it was designed, and consistent improvement in this type of locomotive can be expected in the future.

Firing Coal-Burning Locomotives

This report on coal-burning firing practice which was prepared during 1945,* contained a simple set of instructions for use in teaching new firemen. Early in the report the opinion is expressed that it is not necessary to know anything about the theory of combustion in order to fire an engine properly—a fireman may have learned to apply the principles without knowing the reason for doing so. However, when endeavoring to explain to firemen the necessity for doing certain things to get the proper results, there are three fundamentals which need to be kept in mind. These are the conditions necessary to produce heat in the locomotive firebox: First, there must be a supply of fuel. Second, there must be a plentiful supply of air. Third,



W. C. Shove,
Chairman

the air and the fuel must be brought together at a temperature at which they will burn. With these conditions satisfied there will always be burning, and the instructions in the details of firing practice set forth in the report are all built up from them.

Discussion

Among the conditions favoring fuel economy mentioned in the discussion of the report is a good-riding engine. Slack between the engine and tender will cause coal to be shaken off the grates below the stoker distributing plates.

At least two of the discussers advocated the opening of the fire door when approaching towns to keep smoke from forming, a practice which is not causing any trouble with leaky flues. In his closing remarks, the chairman said that, even with locomotives having welded flues, he did not like to have the engine-men run down hill with their fire doors open.

In St. Louis, where there is a rigid smoke ordinance which is rigidly enforced, horseshoe banks are employed on locomotives which are standing under fire in the terminals. When preparing for the trip some firemen insist on shaking down the fire and breaking up the bank before leaving. It has been found that the bank need not be disturbed but can be burned out without the formation of clinker in a distance of 10 or 12 miles; if a bank forms after the fire is hot, clinker will form.

A considerable part of the discussion was devoted to the problem of the selection and training of new firemen and to the qualifications of road supervisors. On the Canadian National one feature of the educational program is the holding of monthly meetings, each devoted to a different topic, which is studied and discussed. These have stimulated more rapid development of the men on the job. No men are hired who have had less than two years in high school. Several references were made to the importance of sympathy and understanding for the men as a qualification of a successful supervisor. This was summed up by Robert Collett, St. L.-S. F., who said, "To have a friend you must be a friend."

The report was signed by W. C. Shove (chairman), general road foreman engines, New York, New Haven & Hartford; H. E. Tewksbury, Bangor & Aroostook; Clark Harding, Louisville & Nashville; W. E. Small, Boston & Maine; F. X. Jones, supervisor fuel and locomotive operation, Erie; J. H. Simmons, New York Central; H. Morris, superintendent fuel and locomotive

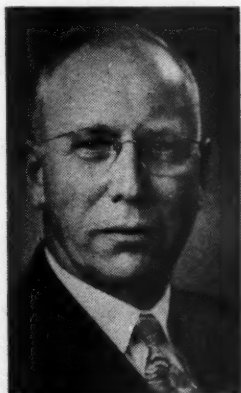
* See *Railway Mechanical Engineer* for November, 1945, page 491.

performance, Central of New Jersey; S. M. Roth, superintendent locomotive performance, Western Maryland; G. B. Curtis, road foreman engines, Richmond, Fredericksburg & Potomac; W. R. Sugg, general supervisor air brakes, Missouri Pacific; H. T. Clark, supervisor locomotive operation, Baltimore & Ohio; A. Baxter, Denver & Rio Grande Western; W. E. Beaver, general road foreman engines, Southern; R. A. Reeder, superintendent fuel and locomotive performance, Reading; J. G. Crawford, fuel engineer, Chicago, Burlington & Quincy, and J. Mattise, superintendent air equipment, Chicago & North Western.

The Road Foreman's Part in Educating Enginemen and Firemen

Theo. Olson, superintendent motive power, Chicago Great Northwestern, presented an address dealing with the part of the road foreman in the education of enginemen and firemen which was prepared during 1945 and presented before this year's annual meeting for discussion.* At the outset Mr. Olson referred to the functions of enginemen in breaking in and training firemen, a system which is most effective when engine crews are regularly assigned and work together for a period of time. He said, however, that present-day methods of operation have minimized the opportunity for enginemen to educate the firemen, and their training, as well as that of the enginemen in train handling, must fall on the railroad foremen or the traveling firemen.

On railroads where traveling firemen are not maintained the road foremen must ordinarily cover the entire field of supervising and instructing engine crews in the proper handling of locomotives and air brakes, as well as in the economical use of fuel through skillful handling of the locomotive and proper firing.



Theo. Olson

Under these conditions Mr. Olson set forth the following list of duties which should be assumed by the road foreman:

- 1.—Riding with inexperienced enginemen and new firemen frequently and instructing them in proper handling of their duties.
- 2.—When there are no new or inexperienced men in the service, spend most of the time riding with and instructing the enginemen and firemen whose work is not up to average.
- 3.—Analyze and make prompt investigation of all engine delays and failures and discuss the reasons and means of preventing recurrence of such failures with the enginemen in daily contacts with them.
- 4.—Keep familiar with methods of drafting locomotives and watch closely this phase of locomotive operation.
- 5.—Hold meetings monthly at each important terminal to discuss with enginemen any current problem that may exist. Make an effort to provide sufficient instruction literature to enable enginemen to keep fully posted on advancements made in the motive-power field and air brakes.
- 6.—While riding locomotives, make a thorough inspection of the locomotive and report any existing defects. Keep a record of the conditions of locomotives so as to be in a position to assist the mechanical department officers in determining shopping schedules.

* See page 502 of the November, 1945, *Railway Mechanical Engineer*.

7.—Keep a close and detailed check of the manner in which the engine crews perform their duties and how carefully the enginemen are watching important matters such as maintenance of proper water level in the boiler, check of boiler feeding apertures, proper lubrication of locomotives, proper functioning of air brakes and other matters essential to safe operation.

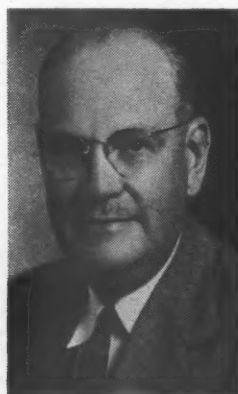
Road foremen are often expected to perform other duties. Where the territory to which the road foreman is assigned and the number of employees he is expected to supervise are sufficient to keep him occupied in carrying out the duties here enumerated, it is the author's opinion that no further duties should be imposed on him. His time should be spent primarily in riding locomotives and supervising the men while engaged in their work.

Discussion

W. C. Shove, general road foreman of engines, New York, New Haven & Hartford, emphasized the many duties which the road foreman has to perform, sometimes even having to act as trainmaster. He particularly emphasized the importance of the road foreman cultivating the friendship of the engine crews, without which, he said, much of the efforts of the road foreman are wasted. He briefly described a system of checking on the road supervision established on the New Haven in 1940. This is in the form of a report by the road foreman for each man visited, showing the date and the character of attention given to him. These records, he said, are invaluable and are frequently called for in investigations.

Studies of Locomotive Combustion

The chairman of the Committee on Front Ends, Grates, Ashpans, and Arches, John R. Jackson, mechanical engineer, A. A. R., presented no formal report. However, he introduced John Hulson, president, the Hulson Grate Company, who showed colored motion pictures of what goes on in a coal-burning locomotive firebox under various combustion conditions. The pictures presented a comparison of the behavior in a Baltimore & Ohio firebox with slotted table grates and in another with



J. R. Jackson,
Chairman

Hulson Tuyere type grates. Shown in slow motion, the effect of the Tuyere grates in reducing the lifting of coal from the fire bed could be observed.

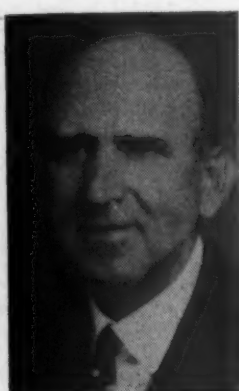
Following the showing of the motion pictures Ed. Benton, Battelle Memorial Institute, reminded the audience that the bituminous coal industry is deeply interested in the railroads as its biggest customer and announced that the Institute now has under way a project to determine the lifting action of the draft in the firebox, how much of the stack loss comes from the grate and how much never lands on the grate, which is being conducted for the Locomotive Development Committee, Bituminous Coal Research, Inc. The Institute, he said, also has under way a research looking toward the reduction of air resistance throughout the combustion sequence.

Allied Supply Association Enrolls

105 Exhibitors at Chicago



C. F. Weil,
President 1943-46



J. F. Gettrust,
Secretary

Available space at the Hotel Sherman fully occupied — Officers elected for new year

At the Hotel Sherman, Chicago, on September 4 to 6, inclusive, a display of railway equipment details and other appliances was held by the Allied Railway Supply Association which exhibits in connection with the meetings of the four Coordinated Mechanical Associations—the Car Department Officers' Association, the Railway Fuel and Traveling Engineers' Association, the Master Boiler Makers' Association, and the Locomotive Maintenance

Officers' Association. There were 105 exhibitors who filled the large exhibit hall and other adjacent available space. No sessions of the four railway associations were held on the afternoon of the first day of their annual meetings in order that the entire half day might be devoted to a study of the exhibits which were also the center of constant attention throughout the meetings.

At the business meeting of the Allied Railway Supply Association held during the course of the exhibit the following officers were elected for the ensuing year: President—M. K. Tate, Lima Locomotive Works, Inc., Washington, D. C.; first vice-president—E. H. Weaver, Westinghouse Air Brake Company, Cleveland, Ohio; second vice-president—B. S. Johnson, W. H. Miner, Inc., Chicago; third vice-president—Walter Sanders, general manager, Railway Sales Division, Timken Roller Bearing Company, Canton, Ohio; secretary—J. F. Gettrust, Ashton Valve Company, Chicago; treasurer—C. F. Weil, American Brake Shoe Company, Chicago.

The names of the exhibiting companies and of the non-exhibiting members of the Association are listed below.

Exhibitors

Adjuster Co., The
Air Reduction Sales Co.
Ajax-Consolidated Co.
American Air Filter Co., Inc.
American Arch Co., Inc.
American Brake Shoe Co.
American K.A.T.
American Locomotive Co.
American Steel Foundries
Apex Tool & Cutter Co., Inc.
Ashton Valve Co.

Barco Manufacturing Co.
Bettendorf Co.
Bowser, Inc.
Buckeye Steel Castings Co.

Cardwell Westinghouse Co.
Chicago Freight Car & Parts Co.
Chicago Pneumatic Tool Co.
Chicago Railway Equipment Co.
Coffing Hoist Co.
Crane Co.

Dampney Co. of America
Dearborn Chemical Co.
Detroit Lubricator Co.
Dicks, C. O., Co.
Double Seal Ring Co.
Duff-Norton Mfg. Co.
Durametallic Corp.

Edna Brass Mfg. Co.
Ewald Iron Co.
Enterprise Railway Equipment Co.

Flannery Bolt Co.
Franklin Railway Supply Co.

Garlock Packing Co.
Giddings & Lewis Machine Tool Co.
Griffin Wheel Co.

Hanna Stoker Co.
Holland Company
Hulson Grate Co.
Hunt-Spiller Mfg. Co.

Independent Pneumatic Tool Co.
Ingersoll-Rand Co.
International Correspondence Schools

Johns-Manville
Joyce-Gridland Co.

Kalmbach Publishing Co.

Leslie Co.
Lima Locomotive Works
Locomotive Finished Material Co.
Locomotive Firebox Co.
Lunkenheimer Co.

MacLean-Fogg Lock Nut Co.
Mall Tool Co.
Manning, Maxwell & Moore, Inc.
McQuade, R. J., Co.
Menasco Mfg. Co.
Michiana Products Corp.
Miller Waste Mills, Inc.
Miner, W. H., Inc.
Modern Railroads Publishing Co.
Modern Supply Co.
Monarch Packing Co.

Nathan Mfg. Co.
National Aluminate Corp.
National Malleable & Steel Castings Co.
New York Air Brake Co.

Oakite Products, Inc.
Ohio Injector Co.
Okadee Co.
Oxi Corp.
Oxweld Railroad Service Co.

Paxton-Mitchell Co.
Porter, H. K., Co.
Prime Mfg. Co.

Railway Equipment & Publication Co.
(Pocket List)
Railway Mechanical Engineer
Railway Purchases & Stores

Sargent Co.
Sellers, Wm., & Co.
Sinkler, Jos., Inc.
Spring Packing Corp.
Standard Car Truck Co.
Standard Stoker Co., Inc.
Superheater Co.
Superior Hand Brake Co.
Superior Railway Products Corp.
Swanson Co.

Talmage Mfg. Co.
Thulin, E. E., Co.
Timken Roller Bearing Co.

Trimount Mfg. Co.
Tube Turns, Inc.

Union Asbestos & Rubber Co.
Union Railway Equipment
Unit Truck Co.

Valve Pilot Corp.
Vapor Car Heating Co.
Viloco Railway Equipment Co.
Vortex Mfg. Co.

Waugh Equipment Co.
Westinghouse Air Brake Co.
Wilson Engineering Co.
Wine Railway Appliance Co.
Worthington Pump & Machinery Corp.

Yale & Towne Mfg. Co.

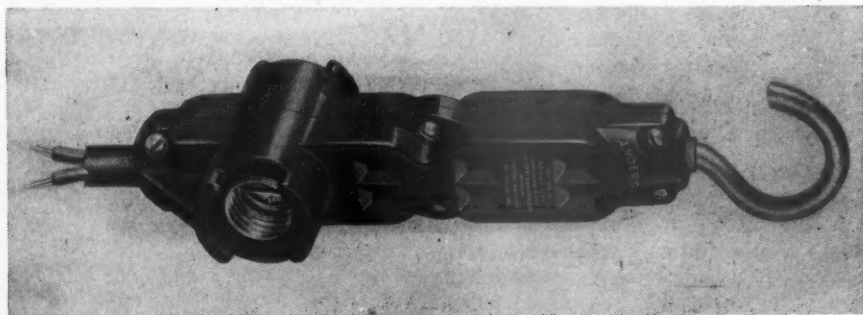
NON-EXHIBITING MEMBERS

American Car and Foundry Co.
Baldwin Locomotive Works
Buda Co., The
Camel Sales Co.
Chicago Tramrail Co.
Coffin, J. S., Jr., Co.
Detroit Graphite Co.
Edgewater Steel Co.
Falls-Hollow Staybolt Co.
General Refractories Co.
Grip Nut Co.
Huron Mfg. Co.
Illinois Railway Equipment Co.
Iron & Steel Products, Inc.
Lehon Co., The
Magnus Metal Corp.
Miller Felpax Co.
Murphy Finishes Corp., a division of Inter-chemical Corp.
National Refining Co.
Pyle-National Co., The
Railroad Equipment News
Shell Oil Co., Inc.
Snap-On Tools Corp.
Standard Oil Co. of Indiana
Standard Railway Equipment Co.
Texas Company, The
T-Z Railway Equipment Co.
Ulster Iron Works
Wilson-Imperial Co.

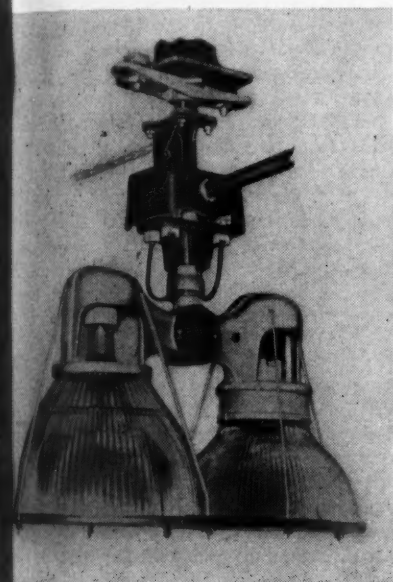
NEW ELECTRICAL DEVICES

Three-Way, Four-Wire Lowering Hangers

Three-way, four-wire, disconnecting and lowering lamp hangers, recommended for indoor service, have been announced by the Thompson Electric Company, Cleveland, Ohio. The hangers are available in three models; with open face sheave housing, with semi-enclosed sheave housing, and with altype sheave housing, the second giving added and the third maximum protection



The unit includes six receptacles and two fuse sockets



Three-way, four-wire hanger in use with two Holophane lighting units

from dust and moisture. In the case of the semi-enclosed unit, the chain or cable delivery to the housing is limited to vertical angles from 15 deg. above to 15 deg. below horizontal. The chain delivery to the seal-type housing is limited to horizontal only. The hangers include all the features of positive latching, positive positioning, no change of polarity, equalized contact pressure and simple manual control. The housing is malleable iron finished with baked black japan, the canopy and spring housing are gray iron, screws, nuts and rivets are bronze. The contacts are cup-and-ball type made of machined brass with brass screws, nuts and washers. All load-carrying parts, except for a manganese bronze latchdog, are cadmium plated or galvanized malleable iron or steel.

Portable Multi-Tap

A portable multi-tap branch receptacle has been developed by the Albert & J. M. Anderson Manufacturing Company, in response to a demand for a unit lighter than the heavy-duty-plugboards made by this company. It is molded from a rugged insulation called Hammertest and is designed for use with light portable tools. There are six receptacles in the unit and two fuse sockets for fusing both sides of the 2-wire

main feeder where it enters. To protect the operator, all live parts are placed well below outside surfaces of the housing. Fuses are protected from injury by projections on the housing which extend beyond the tops of the fuses. The cable entrance takes a $\frac{1}{8}$ -in. outside diameter cable and grips it securely to avoid strain on connections. In place of the hook, a hook and ring may be provided so that, if desired, the cables may be tied to the multi-tap units to prevent their being pulled out by rough handling.

Journal Box Speed Governor

The General Railway Signal Company has developed and extensively tested a new speed governor designed for journal-box mounting. The device is intended for use on Diesel-electric locomotives on which it is not feasible to install axle-type governors because of interference by the drive mechanism. The governor can be mounted on

any standard roller bearing journal box by means of a suitable adapter and a clamping ring, and the combination of journal box, adapter, clamping ring, and gaskets forms a sealed, weathertight unit.

Connection to the locomotive axle is by a universally-jointed splined shaft which engages an internal spline on the axle. The axle spline is formed by pressing an internally splined bushing into a hole bored in the axle, or may be supplied by the locomotive builder as an axle cap unit. Electrical connections are brought out through a rubber hose to the plug coupler visible in the photograph.

In operation, rotation of the splined shaft is transmitted through the universal joint to a scissors-type centrifuge. This centrifuge has its fly-weights arranged symmetrically about a central pivot point, a design which supplies sensitivity to changes in rotational speed, but which is not affected by shocks because of balanced weight distribution.

The governor is available with a maximum of five sets of contacts, one set of which is completely separate electrically, the remaining four sets having one side internally connected through a common supporting bracket. Contacts are silver to silver, with capacity well in excess of normal control circuit requirements. Any set of contacts may be arranged for operation at any speed within range of the device (10 to 110 miles per hour with a 36-in. wheel) by choice of cams and adjustment of contact spacing.

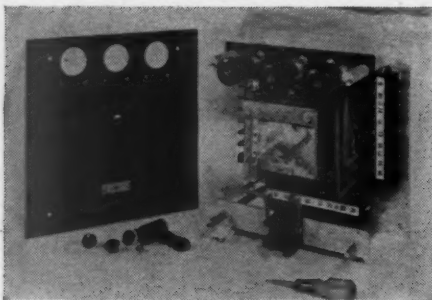
Governors of this type are adaptable for use with speed control and automatic train stop systems. Circuiting can be arranged through the governor contacts to sound warning whistles, to effect brake applications, to prevent release of an automatic brake application until a predetermined low speed is reached, etc. In general, the governor may be used wherever it is desired to have circuit functions determined through speed-controlled contact operation.



Installation on an Electro-Motive Corporation locomotive equipped with Hyatt journal boxes

Simplified Control Panel

A new type of master control panel made by The Fulton Sylphon Company, Knoxville, Tenn., saves time of the train crew by automatically setting up the car for heating, cooling, or ventilation as demanded



A Sylphon master control station with the front panel removed

by the weather through which the car is passing. The Train crew need only select whether the car should be fixed for the day temperature or the night temperature which is 3 deg. warmer than the day setting for coaches, etc., and 5 deg. cooler than the day setting for sleepers.

In some cases, (where 110-volt power is used), three visual fuse indicators project through the front plate of the panel. When the fuse blows, a neon lamp light indicates a fuse failure.

Fluorescent Unit With Center Shield

A fluorescent lighting unit called the "Shield-Flo 40" which employs a porcelain enameled longitudinal shield between the lamps, has been developed by the Benjamin Electric Manufacturing Company, Des Plaines, Ill. The unit gives the same shielding angle on the far lamp as is provided by the reflector on the near lamp. The total overall shielding angle is 27 deg. as compared with the 13-deg. shielding angle of conventional RLM fluorescent units.

The units are also fitted with a feature known as the "Springlox" safety lamp holder. One end of the lamp is pushed into the lamp holder with a flexible spring base and the spring pressure automatically pushes the other end into the facing lamp holder, eliminating the need of adjusting lamp contact prongs in the lamp holder. Pressure of the spring locks the lamp into position, and affords positive insurance against lamps dropping out.

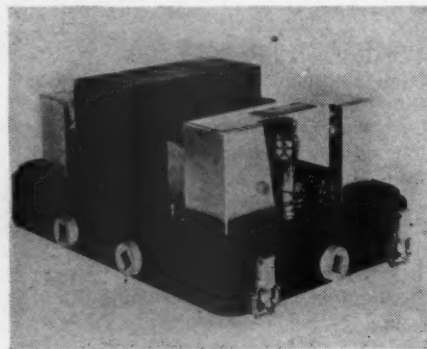
An additional feature of the line is the adjustable "Lok-Latch" reflector fastener

which combines positive attachment of the reflector to the housing with ease of operation. No tools are required; a quarter turn with the fingers quickly attaches or removes the reflector from the housing. An aluminum grommet protects the reflector finish from abrasion by the fastener.

Power Units For Train Communication

Vibrating type d. c. voltage boosters and d. c. to a. c. invertors, designed to power railway radio transmitters and receivers have been developed by Electronic Laboratories, Inc., Indianapolis, Ind.

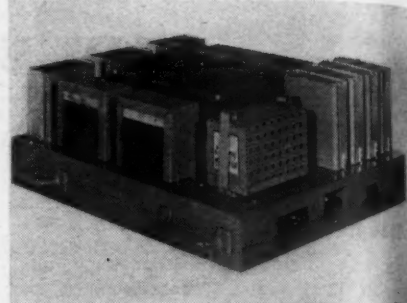
The Model 2600 unit is designed to operate from a nominal input voltage of 64 volts d. c., with provision for giving regulated voltage to the loads while the input



Voltage booster for producing 300 milliamperes at 320 volts from d.c. power at 56 to 80 volts

voltage is varied over a range of from 56 to 80 volts. Vibrator frequency is 100 cycles per second. The unit supplies 320 volts d. c., at 300 milliamperes, as well as other output voltages. A second unit now in production is similar in input voltage to the preceding, but has an output of 117 volts a. c. and a power capacity of 300 watts. Vibrator frequency for this unit is 60 cycles per second.

As a result of the magnetic regulation system employed, the power input to the converter will be nearly constant over the entire input voltage range for any load within its rating. For both units the output voltage remains within 7 per cent of



A 300-watt inverter which receives power at 50 to 80 volts d.c. and delivers 117-volt 60-cycle a.c. power

its nominal value, while the load is varied from zero to full load for all input voltages within the specified range.

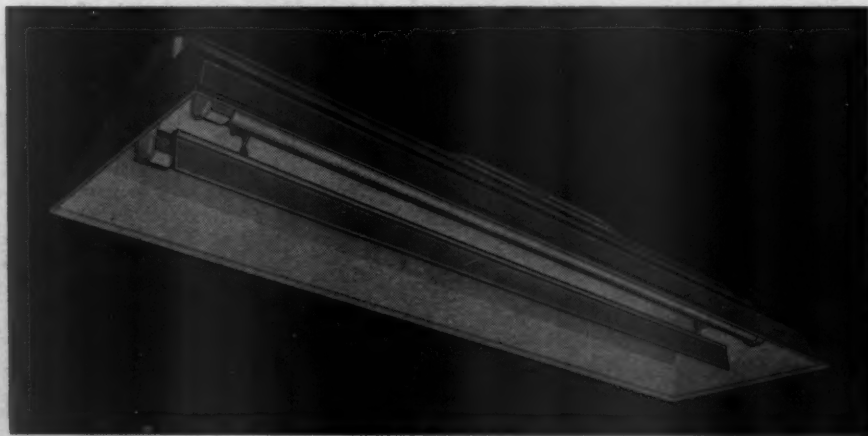
Vibrator operation consists of switching the polarity of d. c. to obtain a. c. and, as a consequence, the a. c. output has a square wave form. In a regulated power supply the high frequency components of the square wave form are filtered out, so as to present a sinusoidal wave form to the load. All a. c. apparatus is designed to operate from a sinusoidal wave form and perfect operation can be obtained from all such equipment when operated from a regulated vibrator power supply.

All-Steel Induction Motors

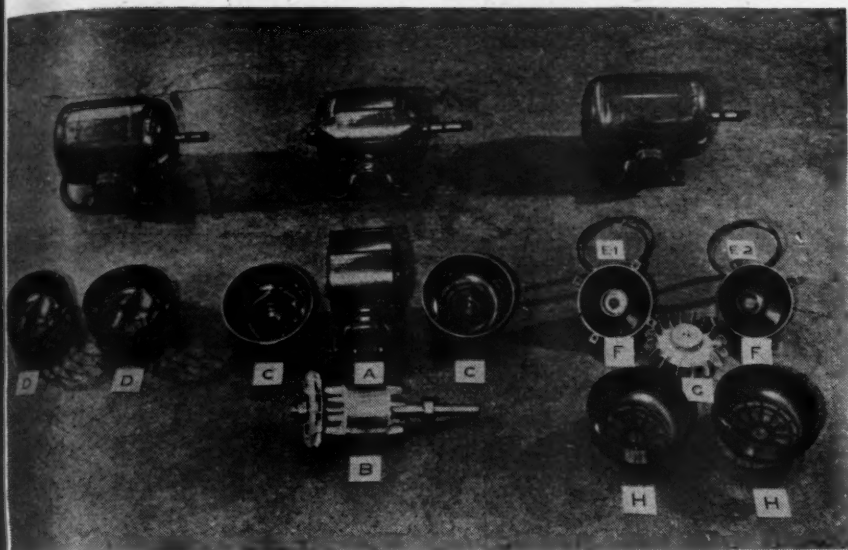
A completely new line of alternating current induction motors is now in production in the recently established Buffalo, New York plant of the Westinghouse Electric Company. The motor, known as the Life-Line, is more than 35 per cent smaller in size than its predecessor. The reduced size has been accomplished without sacrifice of electric properties. Starting torques have been increased as much as 134 per cent per lb. of motor and maximum torques increased as much as 116 per cent per lb. of motor. High efficiencies and power factors are maintained. The appearance is much improved and, maintenance requirements are materially decreased. The bearings are designed to run without attention for at least five years. Shock resistance is increased many-fold. Vibration and noise have been reduced to new low limits. It is also claimed that fewer insulation burnouts will be experienced because of new features in insulating materials and improved winding techniques.

The structural steel sections from which the motor is made are as thick as they would be if made from cast iron, and shock resistance is thereby greatly increased. It has also been determined that steel does not corrode faster than cast iron. Research tests demonstrate the two materials to corrode at equal rates. The explanation for the common belief lies in the fact that when cast iron is replaced by steel, the steel is usually of thinner section and will rust through sooner. Where thick steel sections are used, excessively rapid corrosion is not experienced.

The finish coating on the motor consists of base coats of baked thermoset varnish with a final coat of lacquer. In some extremely severe applications, such as in



The Longitudinal shield provides a total overall shielding angle of 27 deg. as compared with the 13-deg. shielding angle of conventional RLM two-lamp fluorescent units



The three types of motors, "splash proof", "open-protected" and "fan-cooled" and the relatively small amount of component parts required for their assembly

chemical plants, stainless steel will be used for shields and hoods.

The use of steel has resulted in a smaller size. Size is also reduced by an improved cooling system.

The open-protected motor is 83 per cent as large in diameter, and 94 per cent as long, or a saving of 35 per cent of the volume of last year's machines. The new totally-enclosed motor is 83 per cent as large in diameter, and 82 per cent as long, saving 44 per cent of the volume of its predecessor. (Standardized NEMA dimensions have been maintained.) Sizes of electrical working parts have remained substantially the same.

Smooth, quiet operation has been accomplished by careful engineering and through precision manufacture. Mechanical harmonic forces produced by unbalance, are eliminated by dynamic balancing. Further improvement in mechanical balance is obtained in these motors through straighter shafts and improved bearing concentricity. Spiders are shrunk and not pressed on shafts.

Completely proven prelubricated ball bearings are used throughout the line. It is felt that five years without relubrication is conservative. Originally the bearings are expertly greased in the factory with high-quality, long-life material. Relubrication with comparable methods and grease will prolong the life of the motor.

Winding has been made much easier and there is less handling and bending of the coils with a consequent reduction of damage. Winding materials are of high quality, synthetic resin-covered wire. Multiple dips and bakes of thermoset varnish give a hard, smooth, and well-protected winding. The shortened coil extensions used are less vulnerable to damage.

Several types of motors are attained through extensive interchangeability of parts.

The illustration shows three popular types with their component parts. Left to right are splash-proof, open-protected, and totally-enclosed fan-cooled. The open-protected consists of stator (N), brackets (C), and rotor assembly (B). To make it splash-proof, the brackets (C) are oriented

with their openings facing upward and the hoods (D) placed over the ends. Space between the hoods and the brackets allows air to enter and leave.

To make a totally-enclosed fan-cooled motor, the frame (A) and the rotor (B), without fan, are used with brackets (F), spacers (E-1 and E-2), blower (G), and hoods (H). The brackets seal the inside and support the bearings. Air, pulled in through a hood, is directed between the frame ring and the stator iron, and exhausted out of the other hood. The conduit box may be reversed by reversal of the frames on each of these three types.

Air-Conditioning Refrigeration Unit

A refrigeration unit with a direct-driven compressor and an evaporative-type condenser has been developed by the Safety Car Heating and Lighting Company, New Haven 4, Conn. The compressor unit has four cylinders arranged in "V" form and operates at sufficient speed for direct connection to the driving motor.

The evaporative condenser is used to save condenser weight and size, and to lessen the power requirements of the fan. Cooling is produced by a combination of a water spray and air circulation. The air supply is obtained from an axial-flow fan

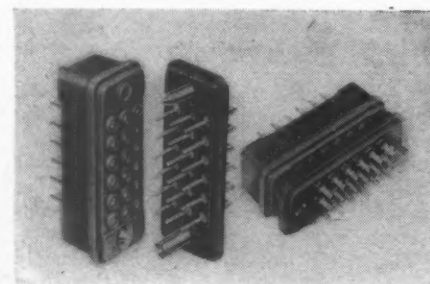
mounted on the driving motor shaft. The water for cooling comes from the water supply of the car and from the condensate which forms on the cooling coil. In operation, make-up water from the car system may not be required. The cooling water is sprayed on the condenser by the fan which takes water from the sump and projects it on the coils. The water that is not evaporated returns to the sump from which it is recirculated.

Control of this device is by two thermostats. The compressor operates at full speed until the higher thermostat is satisfied, at which time the control unit operates to reduce the compressor motor to half speed. Operation at half speed continues until the second thermostat is satisfied, when operation is stopped, to be resumed at half or full speed as conditions may require.

Monoblock Connector

A multiple contact connector, developed by the Winchester Company, New York, is adapted to limited space applications where reliable plug-in operation is required. It can be supplied with a self-contained locking device which eliminates the necessity of any external clamping arrangement.

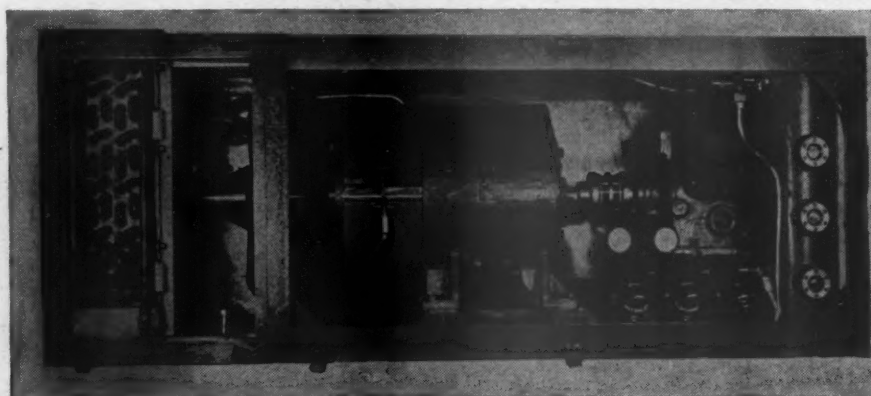
Molded of Melamine plastic, the one-piece inserts minimize the danger of flash-over due to moisture and dust accumula-



Eighteen-contact plug and receptacle units, separated and in contact

tions. Two heavy guide pins, acting as ground contacts, perform the dual functions of alignment and polarization.

The multiple telescoping barriers which serve to isolate contacts increase both surface creepage and air gap between adjacent contacts. A minimum air gap of 1/4 in. is



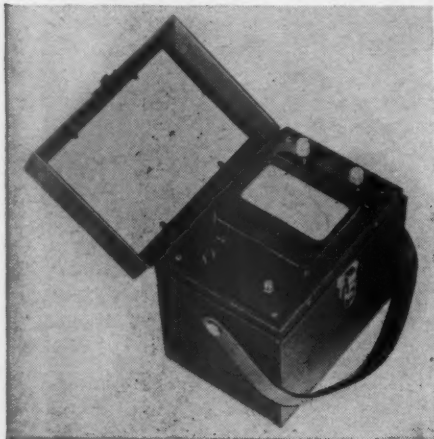
Refrigeration unit with evaporative-type condenser and four-cylinder compressor unit

maintained between all contacts. Contacts are designed for use with a maximum wire size of No. 16 AWG. The connectors are available respectively with 12 or 18 contacts and can also be supplied fitted with conventional straight type contacts.

Insulation Resistance Meter

A portable, self-contained insulation resistance meter, testing to 50,000 megohms, (center scale 1,200 megohms), is announced by Associated Research Inc., 231 South Green street, Chicago 7.

The unit gives positive and definite readings of resistance. Accuracy is insured by a hand-stepped scale. It calibrates at in-



Model 261 Vibrotest insulation resistance tester

finity, thus maintaining accuracy at the high-value part of the scale. It has a high-voltage regulator in the measuring circuit and is equipped with a condenser charging circuit to facilitate faster testing of condensers or capacity circuits.

The tester has its own power supply which develops 500 volts for testing from two No. 6, 1½-volt dry cells. It is housed in a weatherproof metal case with carrying strap. The case is 8¾ in. by 6 in. by 8¾ in. and weighs 17½ lb.

Electronic Tachometer

An electronic tachometer designed for measuring rotating speeds from 300 to 50,000 r. p. m. has been announced by the Special Products Division of the General Electric Company. Weighing only 19 lb., the tachometer is useful for the production testing of equipment instantaneously without the necessity for any permanent attachments.

It consists of a small pick-up head, six feet of flexible cable, and a measuring unit with a panel-mounted indicating instrument reading directly in r. p. m. Either a low-speed or high-speed head can be used with the instrument. The low-speed head provides five speed ranges, 0-1000, 0-2000, 0-5000, 0-10,000, and 0-20,000 r. p. m., while the high-speed head provides three speed ranges, 0-10,000, 0-20,000 and 0-50,000 r. p. m.

Each pick-up head consists of a light-



The tachometer measuring the speed of a milling cutter

interrupting disk and a phototube. Light shining upon the phototube through the openings in the rotating disk produces input signals which are then transferred to the measuring unit, which indicates the r. p. m. of the equipment being tested. The shaft to which the disk is attached rotates on ball bearings and requires very little torque. Therefore the speed of the equipment being measured is not reduced by the use of the tachometer.

Armor-Clad Lighting Units

Armor-clad lighting units designated as Steelites are now being offered by the Benjamin Electric Manufacturing Company, Des Plaines, Ill. The units are highly efficient and are designed to stand up under severe mechanical strain and unfavorable atmospheric conditions.

They consist essentially of an Alzak aluminum reflector, enclosed in a protective steel housing to guard against damage



The units have protected metal housings, Alzak reflectors and sealed, smooth glass covers

normally caused by rough handling and from flying metal particles. The bottom of the housing is sealed against dust, moisture and corrosive fumes by a hinged cover, equipped with tempered plate glass which offers high resistance to sudden impacts and is not affected by temperature changes.

The smooth glass cover which is easy to clean is mounted in a cast aluminum frame and is sealed by a nonhardening gasket. The cover frame is hinged in the closed position by six compression type, thumb latches fastened to the cover band, which lock over the outer rim of the housing. The housing is protected by a fused-to-metal coat of vitreous porcelain enamel over which is applied a surface of synthetic, acid resisting, green baked enamel. The units are supplied in three reflector arrangements; narrow beam, concentrating and spread type. They are listed as vapor-tight by Underwriters Laboratories.

Lamps For Floodlight Service

Floodlight lamps for indoor and outdoor service on 115-, 120- and 125-volt circuits in clear, reflector and projection types are now available from Sylvania Electric Products, Inc., Salem, Mass. Ratings of the clear types, designed for operation with reflectors and preferably in horizontal or vertical position, range between 250 and 1,000 watts with an average rated life of 800 hours. Inside frosted reflector types rated at 150 and 300 watts with 1,000 hour average life provide an efficient means of floodlighting large areas with controlled light. Projector flood types rated at 150 watts and 1,000 hours average life are particularly suitable for outdoor use. Inbuilt reflectors and special hard glass resist conditions due to rain, snow and other outdoor weather conditions. Clear and reflector types rated at 400 watts or less are supplied with medium bases. Mogul bases are used for higher wattages. Projector flood types are supplied with medium skirted bases to eliminate the possibility of loose bases when the lamps are used outdoors.



A projector-flood, a reflector-flood and a clear lamp for various floodlighting applications

NEWS

Welding Society to Meet At Atlantic City

The twenty-seventh annual meeting of the American Welding Society will be held at the Hotel Ambassador, Atlantic City, N. J., on November 17-22, inclusive. A total of 80 technical papers has been scheduled for presentation at the 24 sessions covering 15 divisions of the welding field.

The papers scheduled for the railroad session on Monday morning, November 18, are: Quantity Production of Railroad Passenger Cars by Resistance Welding by A. M. Unger, Pullman-Standard Car Manufacturing Co.; Locomotive Boilers—Welded Construction by James Partington, American Locomotive Company, and Welded Freight Car Construction by R. L. Rex, Air Reduction Sales Co. The chairman of the session will be A. G. Oehler, electrical editor, *Railway Mechanical Engineer*; the vice-chairman, J. W. Sheffer, American Car and Foundry Co.

In addition to the papers dealing specifically with car and locomotive construction there will be 11 papers on welding research, 3 on resistance welding, 4 on pressure welding, 7 on cutting, 3 on weldability, 3 on electrodes, 4 on production welding, 3 on pressure vessels and storage tanks, 3 on machinery, 3 on shipbuilding, 4 on aircraft, 3 on structural welding, 4 on hard facing and 3 on high alloys. Nine papers will also be presented covering a variety of subjects such as the arc welding of cast iron with nickel electrodes, flame-hardening and plant maintenance.

The president of the Society, Wendell F. Hess, will preside at the annual dinner on November 21 during which the presentation of medals and prizes will be made. Other features of the meeting will be the Adams Lecture on Monday evening, November 18, to be given by Dr. Hess, Rensselaer Polytechnic Institute; the University Research Conference on Tuesday evening, November 19, and the annual dinner of the Section officers, followed by a session devoted to Section activities, on Wednesday evening, November 20.

The President's Reception for members and guests of the Society will be held on Sunday evening, November 17, from 5 to 7.

Jackson Becomes A. A. R. Mechanical Engineer

J. R. JACKSON, engineer of tests of the Missouri Pacific at St. Louis, Mo., has been granted a leave of absence to serve as mechanical engineer of the A. A. R., Mechanical Division, with headquarters at Chicago. Mr. Jackson was born May 5, 1886, at Ft. Wayne, Ind., and educated in the public schools of Ft. Wayne and at Purdue University where he graduated with a bachelor degree in mechanical engineering in 1910 and a masters degree in 1915.

Mr. Jackson served as machinist apprentice on the Pennsylvania and, after graduating from Purdue in June 1910, was employed in the test department of the At-



J. R. Jackson

chison, Topeka & Santa Fe until October, 1917, advancing through various grades to assistant engineer of tests, with headquarters in Chicago. He joined the United States Army, serving as captain, Ordnance Reserves, from October, 1917, until March, 1919. He went to France to serve on the staff of the American Commissioner, Anglo-American Tank Commission (Paris) as experimental officer, keeping in touch with

experimental and development work of the French Tank Corps, and held a commission as Major, Ordnance Reserve Corps, for 10 years after discharge in March, 1919.

Mr. Jackson resumed civilian duties as mechanical engineer, Division of Operation, United States Railroad Administration, Washington, D. C., and held that position until March 1, 1920. He then became mechanical engineer and later chief engineer for the Lewis Engineering Co., Chicago and Toronto, Canada.

In 1923 and 1924, Mr. Jackson was engaged in general engineering work as a co-partner in Pioneer Precooling Plants, Calif. On July 1, 1925, he became engineer of tests, Missouri Pacific Lines at St. Louis, in which capacity he organized a new department to take care of the inspection of materials established chemical and physical laboratories, and carried on the work of testing materials and appliances, standardizing specifications, and making reports covering tests and special investigations.

Mr. Jackson has actively participated in committee work for the A. A. R. Mechanical Division, American Society for Testing Materials, A. S. M. E. Railroad Division of which he is a past chairman, and Railway Fuel and Traveling Engineers' Association of which he is a past president.

Orders and Inquiries for New Equipment Placed Since the Closing of the September Issue

LOCOMOTIVE ORDERS			
Road	No. of locos.	Type of loco.	Builder
Erie	9	1,000-hp. Diesel-elec. switchers	American Loco. Co.
	6	660-hp. Diesel-elec. switchers	American Loco. Co.
	1	380-hp. Diesel-elec. switcher	American Loco. Co.
	2	1,000-hp. Diesel-elec. switchers	Baldwin Loco. Wks.
	2	660-hp. Diesel-elec. switchers	Baldwin Loco. Wks.
Gulf, Mobile & Ohio	45 ¹	1,500-hp. Diesel-elec. frt.	American Loco. Co.
	1	1,500-hp. Diesel-elec. frt.	Ingalls Shipbuilding Corp.
Kansas City Southern	5 ²	6,000-hp., 4-unit Diesel-elec. frt.	Electro-Motive
	2 ³	3,000-hp., 2-unit Diesel-elec. pass.	Electro-Motive
	12 ³	1,000-hp. Diesel-elec. switchers	Electro-Motive
	1 ³	8,000-hp., 4 unit Diesel-elec. frt.	Fairbanks, Morse
LOCOMOTIVE INQUIRIES			
Clinchfield	4-8	4-6-6-4	
FREIGHT-CAR ORDERS			
Road	No. of cars	Type of car	Builder
Atchison, Topeka & Santa Fe	1,000	50-ton box	Co. shops
Baltimore & Ohio	1,000 ⁴	50-ton box	Pressed Steel Car
Donner-Hanna Coke Corp.	85	70-ton hopper	American Car & Fdry.
Illinois Central ⁵	400	50-ton hopper	General-American
Illinois Terminal	150	50-ton box	American Car & Fdry.
Nashville, Chattanooga & St. Louis	500 ⁶	50-ton box	Pullman-Std.
	200 ⁶	50-ton gondolas	Pullman-Std.
	300 ⁶	50-ton hopper	Pullman-Std.
New York Central	1,000	55-ton box	Co. shops
	1,000	55-ton auto.	Co. shops
Northern Pacific	250	40-ton refrig.	Pacific Car & Fdry.
Pacific Fruit Express	1,000	Refrigerator	Mt. Vernon Car
	500	Refrigerator	Pacific Car & Fdry.
	500	Refrigerator	General-American
	500	Refrigerator	American Car & Fdry.
	500	Refrigerator	Pullman-Std.
Western Maryland	600 ⁷	55-ton hopper	Bethlehem Steel
Western Pacific	250 ⁸	Box	Pressed Steel
FREIGHT-CAR INQUIRIES			
American Refrigerator Transit Co.	2,000	40-ton refrigerator	
Atlanta & St. Andrews Bay	100	50-ton wood-handling	
Baltimore & Ohio	2,000	Hopper	
Central of Pennsylvania	28	70-ton covered hopper	
Lehigh & Hudson River	200	50-ton box	
Detroit, Toledo & Ironton	100	70-ton hopper	
Gulf, Mobile & Ohio	1,500	Box	
Missouri Illinois	100	70-ton hopper	
	50	70-ton covered hopper	
Seaboard Air Line	150	70-ton covered hopper	
Southern Pacific	1,000	50-ton box	

Orders and Inquiries for New Equipment—Continued

PASSENGER-CAR ORDERS			
Road	No. of cars	Type of car	Builder
Chicago & North Western	27 ⁹	Coaches	Pullman-St.
	9 ⁹	Parlor	Pullman-St.
	4 ⁹	Bagg.-mail	Pullman-St.
	4 ⁹	Tap-diner-lounge	Pullman-St.
	1 ⁹	Cafe-coach	Pullman-St.
Delaware, Lackawanna & Western	15 ¹⁰	Dining	Pullman-St.
	15 ¹⁰	Coaches	American Car & Fdry.
	2 ¹⁰	Dining	Budd Co.
	2 ¹⁰	Tavern-lounge	Budd Co.
	16 ¹¹	Elec. coaches	American Car & Fdry.
Reading Southern ¹²	5	Mail-bagg.	Pullman-St.
	71	Sleeping	Pullman-St.
	9	Dining	Budd Co.
	26	Coaches	Budd Co.
	6	Lounge-coaches	Budd Co.
	4	Bagg.-dormitory	American Car & Fdry.
	3	Lounge-bar	American Car & Fdry.
	2	Dining	American Car & Fdry.
	3	Mail-bagg.	American Car & Fdry.
	11	Coaches	American Car & Fdry.

¹ Twenty-two of these units have already been delivered.

² Delivery scheduled for mid-1947.

³ To be geared for a maximum speed of 65 m.p.h. for use in mountainous section between Pittsburg, Kan., and De Queen, Ark. Delivery scheduled for November.

⁴ Delivery to begin first quarter of 1947.

⁵ The current schedule of the Illinois Central's car shops at Centralia, Ill., calls for the production of 1,750 new freight cars before April 1, 1947. The first lot of cars to be produced will consist of 300 steel automobile box cars equipped with wrought-steel wheels of the passenger-car type. The remainder of the schedule includes 500 standard box cars, 500 flat cars and 450 hopper cars. A succeeding program for 1947 is expected to include 500 additional automobile box cars and 1,000 more standard box cars.

⁶ Estimated total cost \$3,500,000.

⁷ Delivery late in first quarter, or early in second quarter 1947.

⁸ Estimated total cost \$1,050,000.

⁹ These cars will be used to equip new "400" type streamline trains to be operated between Chicago and Omaha, Neb.; Sioux City, Iowa, and Omaha (connecting with the Chicago-Omaha streamliner at Missouri Valley, Iowa); Chicago and Ashland, Wis.; and Chicago and Rochester, Minn., and Mankato.

¹⁰ Deliveries of this equipment is expected during the second and third quarters of 1947. The purchase of 3 sleeping cars for use in joint service with the New York, Chicago & St. Louis between New York and Chicago has been authorized by the board of managers of the D. L. & W.

¹¹ To be operated as two-car units. The electrical equipment will be built by the General Electric Co. The coaches, to cost \$1,173,500, will seat a total of 1,376 passengers and will be used to supplement present equipment in the road's electrified suburban territory. Delivery is to be made in one year.

¹² Orders placed by the Southern acting for itself and as agent for the Cincinnati, New Orleans & Texas Pacific, the Florida East Coast, the Louisville & Nashville, the Atlanta & West Point, and the Western of Alabama. Eighteen of the 23 cars ordered from American Car and Foundry will be of aluminum construction, and the remaining 122 cars will have stainless-steel exteriors.

NOTE:—The Chesapeake & Ohio, the New York, Chicago & St. Louis, and the Pere Marquette are contemplating the complete replacement of all their main-line passenger equipment, according to an announcement by Robert R. Young, chairman of the C. & O. board. Inquiries have been placed with car builders for equipment to supplant that of the two new streamlines "Pere Marquettes" on the Detroit-Lansing-Grand Rapids run. They would supply also the units for other trains on the Chesapeake & Ohio which already has under construction two de luxe streamliners. These streamliners, being built by the Budd Company, will introduce many new features conducive to passenger comfort and safety, including ultra-modern air purification and sanitation, and observation vista domes, the announcement says.

A. A. R. Conventions at Atlantic City Next June

FOR the first time in a decade the Mechanical division, A. A. R., and the Purchases & Stores division, A. A. R., will hold their annual conventions in Atlantic City, N. J., next year, during the week beginning June 23. The meetings will be held in Convention Hall which will also house the exhibit of the Railway Supply Manufacturers' Association. While the convention sessions will be concluded on Friday, the exhibit will remain open at least part of Saturday.

Research Group Orders Two Coal-Burning Gas Turbines

ORDERS have been placed for two gas-turbine locomotive units, including electric generators, by the Locomotive Development Committee of Bituminous Coal Research, Inc., according to Roy B. White, chairman of the committee and president of the Baltimore & Ohio. One unit will be built by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., and the other by the Elliott Company, Jeannette, Pa. Each will be encouraged to exercise its ingenuity in developing design details, Mr. White said.

The American Locomotive Company, the Baldwin Locomotive Works and the Lima Locomotive Company each have agreed to submit designs for the chassis and running gear of two test locomotives to be powered by the coal-fired gas turbines, and orders for this machinery will be placed after the designs have been studied by the committee, so that two complete test locomotives can be assembled.

This arrangement will make possible the construction of two complete gas-turbine locomotives which, it is expected, will be available for test purposes at about the same time. This increases substantially the scope of the project as originally planned and is expected to expedite the development of a satisfactory coal-burning gas-turbine locomotive for railroad use. It is confidently believed by those in charge of the project that these locomotives will create a new standard of performance and will at the same time make available a wide variety of fuels for use as gas-turbine fuel.

Boston & Maine Discards Electric Locomotives

ELECTRIC locomotives which for the past 36 years have hauled Boston & Maine freight and passenger trains for 4¾ miles through the Hoosac tunnel under

the Berkshire hills, ceased operation on August 25 as Diesel-electric locomotives took over complete operation of all through trains on the Fitchburg division main line. The change also marks the passing of all steam locomotive operation on the portion of the railroad's main line between Troy and Mechanicville, N. Y., and Greenfield, Mass.

With the Boston & Maine's new Diesel-electric locomotives hauling both passenger and freight trains, the trains now pass through the tunnel without delay of stopping at either end to attach and detach electric engines.

Railroad engineering crews are removing the overhead wires and other electric apparatus which was necessary for the electric locomotive operation.

Diesel Locomotive Booklets—A Correction

THE Set of Five Booklets on Diesel Locomotives published by the International Textbook Company cost \$6.55, not \$5.55 as given in the review on page 483 of the September *Railway Mechanical Engineer*.

Shop Construction Programs

Reading.—The Reading has awarded a contract to the Geo. A. Fuller Company, Baltimore, Md., for an enginehouse extension at Rutherford, Pa. The estimated cost of this project is \$150,000.

Saratoga & Schuylerville.—The S. & S. according to J. M. Tinsley, president of the road, is contemplating a \$200,000 expansion program which will include the construction of an enginehouse and repair shop.

Southern.—The Southern plans to construct a modern Diesel-electric locomotive heavy repair and maintenance shop, at cost an estimated \$887,500, at its City shops in Chattanooga, Tenn. Work on the new facility, the first of its kind on the Southern for the complete overhauling and rebuilding of freight and passenger Diesels, will begin "as soon as possible," according to Ernest E. Norris, president of the road, has announced. Plans contemplate a new building, approximately 132 ft. wide by 294 ft. long, facing the present office and storehouse at the shops. It will contain four repair tracks and a wheel release track, together with machine shop, cleaning room, storage space and other features. Increased oil storage, washing and sanding facilities will be provided nearby.

Clean-Air Committee Formed by Chicago Railroads

A RAILROAD sub-committee of the Clean Air Committee of the Chicago Association of Commerce was formed in Chicago on August 13. T. F. Powers, assistant to the vice-president (mechanical) of the Chicago & North Western, was named chairman of the group, and E. E. Chapman, mechanical assistant (research and engineering) of the Atchison, Topeka & Santa Fe, was selected vice-chairman. The 20-man railroad sub-committee will particularly study ways to reduce pollution of the air from smoke and ashes and from dust raised from the track by passing trains.

A. S. F. Color-Sound Moving Picture

THE American Steel Foundries, Chicago, has just received from Carl Dudley Productions, Beverly Hills, Calif., the first color-sound moving picture which it is believed has ever been made to show the exact functioning of a mechanical appliance in railway road service.

In this instance, the relatively much smoother riding qualities under all speed, load and track conditions of A. S. F. Type A-3 Ride control freight-car trucks, with long-travel springs and friction-snubbed bolsters, are compared with the performance of conventional A. A. R. trucks having shorter springs and no snubbing device. Trucks of these two types were installed for purposes of comparison under two identical A. S. F. test box cars which have made over 100,000 miles of service in connection with the intensive truck development work conducted by this company during the last few years. For picture-taking purposes, the most recent test runs were made with a special train on a railroad main line in California where traffic, weather and lighting conditions were most favorable for moving-picture production.

The two test cars used were fully equipped with accurate shock-indicating and recording mechanism of the latest type, including Miner accelerometers, and easy means of varying the load from zero to full so as to show truck action under different load conditions. Necessary camera equipment and floodlights were mounted on brackets under the cars and directed towards the trucks to give both direct forward and outside quartering views which were never before available. Metal containers with windows protected the cameras and lights against damage from materials accidentally thrown up from the roadway and all camera equipment was operated by remote control. Train stops had to be made to change camera adjustment and film exposure time.

The special train was operated safely at speeds up to 92 miles an hour when both test cars were equipped with Ride-Control trucks, the moving picture giving a permanent visual record of the relatively smooth truck action even at this high speed. The fact that the picture was taken in color gives unusually clear definition and contrast between lights and shadows so that the movement of springs, bolster,

wheels and brake equipment can be analyzed and studied. Sound effects also are faithfully registered for what they may be worth and explanations made vocally.

This new color movie, in the introductory part, presents considerable information of general interest regarding competitive transportation conditions which railroads must meet and emphasizes the importance of safe, smooth-riding and economical freight-car trucks in railway service of the future. The picture was taken primarily with a view to giving railway officers and car department supervisors a clearer idea of what actually happens under cars in general service at modern high operating speeds.

Standard Tests for Mineral-Wool Products

COMMERCIAL Standard CS-131-46 on testing and reporting of all forms of mineral-wool insulation, widely used by the transportation industry for the protection of cargoes in transit, is the latest development in the joint standardization program of the National Bureau of Standards and the Industrial Mineral Wool Institute. Adhesive strength, as an anti-vibration factor, moisture adsorption, density, and fire resistance, in addition to the basic feature of thermal conductivity, are among tested characteristics of importance to the railway industry.

The new standard permits industry-wide bases of judgment and specification in mineral-wool products. It covers testing and reporting on all types of industrial mineral-wool products. The tests described cover all material of fibrous form processed from molten rock, slag, or glass. The forms of products for which test methods are given are blanket, block, board, felt, granulated, industrial batt, insulating cement, loose, and pipe insulation of both blanket and molded forms. Uniform and detailed methods of testing and recording physical and chemical properties are given. The forms of industrial mineral wool are defined and formulas given for fixing the conclusive factor of each test so that standards may be made available for the judgment of characteristics and behavior by uniform tests of any type of industrial mineral wool.

Standard CS-131-46, is issued by the National Bureau of Standards of the Department of Commerce, and contains the names of scores of acceptors throughout the mineral-wool industry. Copies of the stand-

ard are available for distribution and can be secured from the Industrial Mineral Wool Institute, 441 Lexington avenue, New York 17.

Great Western Converts Locomotives to Oil Burning

THE Great Western Railway of England is extending its experiment with oil-burning locomotives to 25 "Castle" class engines, which are to be placed in service on main line runs between London, Bristol, the west of England and south Wales, it has been announced through British railways' headquarters in New York.

Ten freight locomotives already converted to oil-burning have been placed in service in south Wales, and the company is planning to convert eight more for freight traffic. A "Hall" class, general utility type locomotive, also recently converted, will soon be brought into express passenger service between London and Bristol.

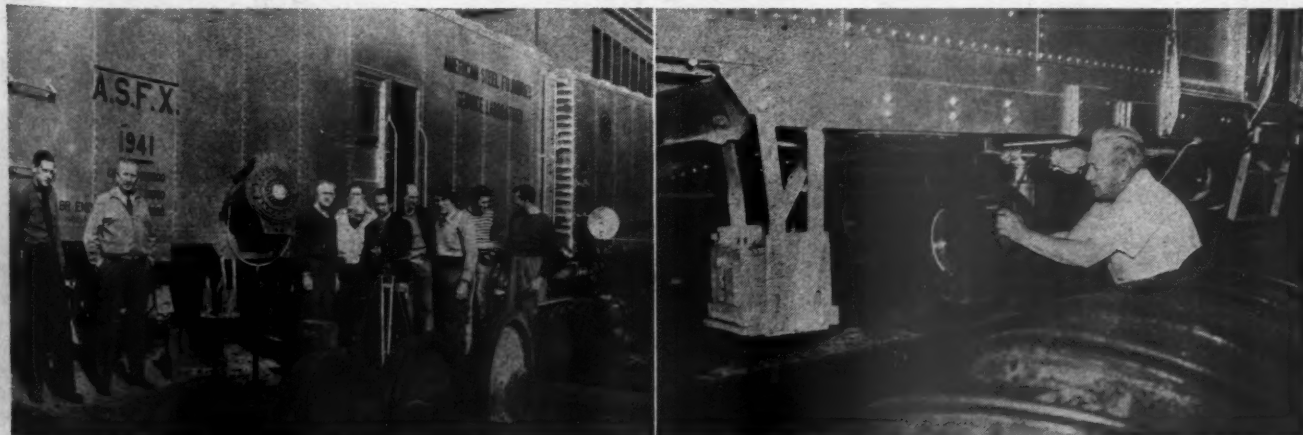
Tests Completed on Two-Unit 4,000-hp. Alco-G.E. Diesel

TESTS on a new two-unit 4,000-hp. Alco-G. E. Diesel-electric locomotive have recently been completed on the Lehigh Valley, according to the American Locomotive Company. For 30 days the new locomotive was used on Lehigh Valley's fast passenger runs between Buffalo, N. Y., and Newark, N. J. During the entire test period, technicians and engineers of American Locomotive and the General Electric Company rode in the locomotive to check operations.

Results of the tests were not announced, but it was said that no "helper" engine was required on the runs over the Wilkes-Barre mountains in Pennsylvania, where one normally is used. On westbound runs the engine was used on the "Black Diamond" and in the eastbound tests it pulled the "Maple Leaf."

M-K-T Plans Dieselization

THE Missouri-Kansas-Texas has announced, through its president, Donald V. Fraser, that plans have been completed for the substitution of Diesel-electric locomotives for steam locomotives throughout the entire Katy system. The new equipment will be placed in operation as rapidly as it is received.



A. S. F. test cars and crew which took color-moving picture—(Right) Close-up of camera box and flood lights under car

Supply Trade Notes

GENERAL ELECTRIC COMPANY. — *R. A. Williamson*, formerly of the General Electric Company's New York office, has been appointed manager of the railroad rolling-stock division, transportation divisions, apparatus department, succeeding *T. F. Perkins*, who has been transferred to the transportation engineering division. Mr. Williamson will be responsible for the sale, application and servicing for all railroad rolling-stock business. This includes straight-electric locomotives, electrifications, steam- and gas-turbine electric locomotives, and railroad export business. His division also will handle electric car equipment for railroad service, and railroad passenger car and caboose equipment, such as axle-driven generators and controls, speedometers, and water fountains.

R. A. Williamson has had 20 years' experience in the design, application, sale and servicing of electric propulsion for all types of motive power. He started early in the transportation field, working for the Boston (Mass.) Elevated Railway in many capacities while taking a cooperative electrical course at the Massachusetts Institute

York Railroad Club, the Technology Club of New Jersey and the Propeller Club, Port of New York.

BUDD COMPANY. *Warren H. Farr*, vice-president of the former Budd Wheel Company, has been appointed vice-president in charge of manufacturing of the Budd Company, with headquarters in Philadelphia, Pa. Mr. Farr will be in charge of manufacturing in the Detroit, Mich., and Philadelphia automotive plants, and the railway car plant in Philadelphia. As an engineer and



Warren H. Farr

works manager Mr. Farr's experience brackets the history of the automotive industry. He was a young engineer working for Buick soon after the company began the manufacture of automobiles. He also took part in the engineering development of the Chevrolet, Durant six, the Sheridan car and the Sampson tractor, and was with Studebaker for three years before W. C. Durant drafted him during the creation of the Chevrolet Motor Company. Mr. Farr was works manager for the Flint Motor Company when he joined Budd in 1927.

INLAND STEEL COMPANY. — *Leigh B. Block*, vice-president of the Inland Steel Company, has been elected a director of the firm, succeeding *J. H. Morris*, who retired recently as secretary of Inland Steel.

UNION ASBESTOS & RUBBER COMPANY. — The Union Asbestos & Rubber Company, Chicago, has announced a program to expand its Blue Island, Ill., plant. The program involves the installation of additional heavy machinery and equipment to be completed in the early fall and the extension of several buildings scheduled for completion by the first quarter of 1947.

PANTASOTE PLASTICS, INC. — The managements of the *Pantasote Company*, Passaic, N. J., and the *Textileather Corporation*, Toledo, Ohio, have announced the conclusion of negotiations to merge the companies into a new corporation to be known as *Pantasote Plastics, Inc.* The new corporation, like its predecessors, will produce artificial leathers, plastic-coated fabrics and vinyl resin film.

Hans Wyman, president of *Pantasote*, will be president of *Pantasote Plastics*, and *J. D. Lippman*, president of *Textileather*, will be a vice-president of the new company.

NOX-RUST CHEMICAL CORPORATION. — *Ray D. Cunningham* has been appointed director of sales of the *Nox-Rust Chemical Corporation*, Chicago. Mr. Cunningham was previously general sales manager of the *Wolf's Head Oil Refining Co.*, Oil City, Pa.

PERMUTIT COMPANY. — *John C. Tracey* has been appointed sales engineer of the Washington, D. C., office of the *Permutit Company*. Mr. Tracey was formerly a lieutenant colonel with the United States Army Engineers.

CUMMINS ENGINE COMPANY. — *Don Cummins* has been appointed quality manager of the *Cummins Engine Company* to serve as final authority on decisions affecting the quality of *Cummins* engines. Mr. Cummins, who has been with the company since 1919, played an important



Don Cummins

role in developing the high-speed Diesel introduced by *Cummins* in 1932. For the past five years he has been director of research, in charge of the company's experimental and test laboratory, working closely with *H. L. Knudsen*, vice-president in charge of engineering. Mr. Cummins planned the building in which the *Cummins* fuel and injection system is manufactured. He will have complete charge of all inspection departments, including inspection of purchased materials, and will also be in charge of a program to interpret and teach the "user's point of view" to every member of the organization.

GRAVER TANK & MFG. CO., INC. — *John E. Fogarty*, formerly manager of the weldment division of the *Graver Tank & Mfg. Co., Inc.*, has been appointed general manager of the company's Sand Springs, Okla., plant. *Edward B. Heyden*, formerly with the *Lummus Company*, has been placed in charge of *Graver's* construction division, replacing *Lloyd K. Wells*, who has retired.



R. A. Williamson

of Technology, of which he is a graduate with a master's degree in electrical engineering (1927). He immediately went "on test" with General Electric at the Erie Works and from there, in April, 1928, transferred to the transportation control engineering division, doing design and application work on the 3,000-volt d.c. electrification of the Delaware, Lackawanna & Western M. U. cars for suburban service in New Jersey. In April, 1930, he joined the service engineering division of the New York office to supervise the Lackawanna installation. Subsequently, he did similar work on the New York Central, the Pennsylvania, the Brooklyn-Manhattan Transit and the Hudson & Manhattan. Mr. Williamson became marine superintendent of the New York district in 1939, supervising the installation of propulsion and electric equipment on ships built in that area. In 1944 he became marine engineer for the district. He is a member of the American Institute of Electrical Engineers, the Society of Naval Architects & Marine Engineers, the New

LIQUID CONDITIONING CORPORATION. — The Liquid Conditioning Corporation has announced the election of the following officers: *S. B. Applebaum*, president; *H. L. Tiger*, vice-president and treasurer; *Norman L. Brice*, secretary and chief engineer; *S. S. Sulzyski*, assistant secretary and controller. The company, located at 423 West One Hundred and Twenty-sixth street, New York, provides equipment and materials for all water conditioning processes for industrial, railroad and household use.

ARO EQUIPMENT CORPORATION.—*E. L. Jackson* and *M. J. Anderson* have been appointed assistant sales managers for the Air Tool division of the Aro Equipment Corporation, Bryan, Ohio.

JOYCE-CRIDLAND COMPANY.—*H. H. Landis* has been appointed eastern division sales manager of the Joyce-Cridland Company, with headquarters at Dayton, Ohio.

SPICER MANUFACTURING DIVISION, DANA CORP.—The name of Spicer Manufacturing Corp. has been changed to the Spicer Manufacturing Division of the Dana Corp. No changes in any phase of the Spicer organization have been made.

AMERICAN CAR AND FOUNDRY COMPANY.—*Robert W. Ward* has been elected a vice-president and placed in charge of manufacturing of the American Car and Foundry Company. *W. E. Lunger* succeeds Mr. Ward as district manager at the Huntington, W. Va., plant. *Norman H. Shipley* has been appointed district manager of the Madison, Ill., plant. *Harold L. Kennedy*, formerly Washington, D. C., district sales manager of the Mt. Vernon Car Manufacturing Company, has joined American Car and Foundry as sales agent in the Washington district sales office. *J. L. Onderdonk* has been appointed an assistant vice-president of the company, with headquarters



W. E. Lunger

and Foundry at Huntington, immediately after graduation and served successively as secretary to the district manager, superintendent of stores and yards, superintendent of the car department, and general superintendent until 1937, when he became district manager.



Norman H. Shipley

W. E. Lunger was born in Danville, Pa. He attended Columbia University, specializing in engineering, and augmented his studies by working at the Berwick, Pa., plant of American Car and Foundry where he received two years' training in shop work. In 1916 Mr. Lunger was appointed



Harold L. Kennedy

field inspector for American Car and Foundry export. He was assigned to the Huntington plant in January, 1923, as mechanical engineer and in 1937 was appointed general superintendent of the plant.

Norman H. Shipley was born in St. Louis, Mo., and educated in the public schools there. He joined American Car and Foundry at the St. Louis plant in June, 1912. While serving in various capacities



R. S. Slater

at the plant he studied mechanical engineering and general administrative work, and in March, 1941, was appointed assistant district manager at Madison. Mr. Shipley is an active member in the Car Department Association of St. Louis.

Harold L. Kennedy began his business career in the supply department of the Central of Georgia at Columbus, Ga. He later became assistant purchasing agent of the Fruit Growers Express Company.

R. S. Slater was born in East Orange, N. J., and was educated in the schools of that community. He joined American Car and Foundry in 1923 as expeditor in the material assembly division of the purchasing department in New York. In 1935, he transferred to the sales department and in 1936 was appointed sales agent in the New York sales department. As manager of tank-car sales Mr. Slater will be in charge of the sales of tank cars, storage tanks and pressure vessels.

UNITED STATES STEEL CORPORATION.—*Arthur C. Wilby* has been elected vice-president of the United States Steel Corporation, with headquarters at Chicago.

AMERICAN ARCH COMPANY.—*Arthur F. Becker* has been elected vice-president in charge of service of the American Arch Company, New York. Mr. Becker was born in Cleveland, Ohio and began his railroad career as an apprentice machinist in the Beech Grove shops of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis, Ind. In 1913, he joined the Toledo & Ohio Central at Bucyrus, Ohio, and later was appointed general foreman of shops of the Michigan Central at Jackson, Mich. He joined the American Brake Shoe & Foundry Co. in 1917 as service engineer and later became plant engineer in Chicago. Mr. Becker joined American Arch as a service engineer in 1921 and



R. W. Ward

at Chicago, and *R. S. Slater* has been appointed manager of tank-car sales, with headquarters in New York.

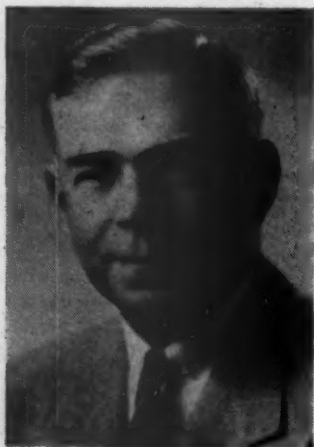
R. W. Ward has served the company in various capacities since 1909 and during the past 10 years has been district manager of the Huntington, W. Va., plant. He was born in Washington, D. C., and attended schools in Ashland, Ky., and Ironton, Ohio. He entered the employ of American Car

subsequently was transferred to plant operations. In 1933, he was appointed assistant to the vice-president in charge of sales, with headquarters in Chicago, where he remained until his transfer last year to the New York office.

◆
WYANDOTTE CHEMICALS CORPORATION.—*Charles O. Chesnut* has been appointed general manager of the newly organized Pacific Division of Wyandotte Chemicals Corporation. Manufacturing and distributing activities in the Pacific States of the products both of the J. B. Ford and Michigan Alkali Divisions of Wyandotte, and of Natural Soda Products Company, will now be directed from the Pacific Division office, 502-14 Central Tower building, San Francisco 3, Calif.

◆
OHIO FERRO-ALLOYS CORPORATION.—*R. A. Mylius*, formerly assistant electrical engineer of the Virginian, has joined the Ohio Ferro-Alloys Corporation of Canton, Ohio. Mr. Mylius will spend three months at the company's Tacoma, Wash., plant, and three months at the plant in Philo, Ohio, after which he will be stationed permanently in Canton.

◆
FAIRBANKS, MORSE & CO.—*E. A. Foster* has been appointed manager of the application engineering department of the Railroad Division of Fairbanks, Morse & Co., with headquarters in Chicago. *J. F. Weiffenbach* has been appointed chief engineer of the Railroad division, with headquarters in Chicago. *Frank Ross, Jr.*, assistant in the Railroad Division for the past year, is now sales engineer in charge of locomotive sales in the St. Louis, Mo., area where he will be located. *Frank M. Bosart* has been appointed eastern manager of locomotive sales,



E. A. Foster

with headquarters in New York. *Robert Aldag, Jr.*, has been appointed sales engineer in the Chicago district, with headquarters in Chicago.

E. A. Foster as manager of the application engineering department of the Railroad Division, will have direct responsibilities for all locomotive application studies. Mr. Foster is a graduate from the University of Illinois with a degree in railway electrical engineering. For the past 10 years he had been in the employ of the Electro-Motive



J. Weiffenbach

Division of General Motors Corporation. In 1939 he was transferred to the Engineering Department of Electro-Motive and for the past two years was locomotive performance engineer.

J. F. Weiffenbach is a graduate of the University of Michigan with a degree in



F. Ross, Jr.

mechanical engineering. He joins the Fairbanks-Morse organization from the Electro-Motive Division of General Motors at LaGrange, Ill., where he was located for the past ten years, doing locomotive engineering and designing.

Frank Ross, Jr., sales engineer in charge



F. M. Bosart

of locomotive sales in the St. Louis area, was at one time associated with the Terminal Railroad Association of St. Louis, where he had charge of Diesel locomotive operation and maintenance.

Frank M. Bosart comes to Fairbanks, Morse & Co. from the Electro-Motive Division of General Motors, having had ten years' service with that division in various capacities both in the service and sales de-



R. Aldag, Jr.

partments. Previously he had been with the Chicago, Rock Island and Pacific.

Robert Aldag, Jr., is a graduate of Purdue University where he specialized in railway mechanical engineering. He started his career with the Erie and later joined the Chicago, Burlington & Quincy where his duties for the past six years have had to do with the operation and maintenance of Diesel locomotives.

◆
PAXTON-MITCHELL COMPANY.—*H. W. Dillon*, service engineer for the Paxton Mitchell Company, Omaha, Neb., has been appointed manager of the North Eastern district, with headquarters as before in New York.

◆
AMERICAN BRIDGE COMPANY - VIRGINIA BRIDGE COMPANY.—*Frank K. McDermott*, vice-president in charge of manufacturing operations of the American Bridge Company (a subsidiary of the United States Steel Corporation), has been elected president of American Bridge and of the Virginia Bridge Company, with headquarters at Pittsburgh, Pa. He succeeds *Leon A. Paddock*, who retired on July 1.

◆
INDUSTRIAL BROWNHOIST CORPORATION.—*Mar Riebenack III*, manager of the Philadelphia (Pa.) office of the Industrial Brownhoist Corporation, Bay City, Mich., has been elected vice-president in charge of sales, with headquarters at Bay City, succeeding *James B. Hayden*, who has retired. The corporation has announced the following additional changes in its sales organization: *H. D. Wright*, manager of the New York office, becomes director of sales for the eastern seaboard, with headquarters at New York; *C. H. White*, district sales manager at Chicago, becomes director of sales for the southern and western portions of the United States, with headquarters at Chicago; *James A. Pe-*

A day with an AMCCW inspector shows why...

"EVERY WHEEL SHIPPED IS AS
GOOD AS THE BEST"



● Take a typical working day for an AMCCW Resident Inspector. At an Association member's plant, he inspects wheels for surface imperfections — at tread, flange, plate and hub. He reviews the casting record of individual wheels — mixture of cupola charge, melting operations, temperature of run, ladle treatment, pouring and annealing operations.

He selects wheels for daily tests, makes tests with rigid adherence to AMCCW's Code of Standards, and submits test reports and manufacturing records to the Association's head Inspection Department in Chicago. There a double check is made and additional tests demanded if they appear necessary.

Thoroughness like this helps to achieve the aims AMCCW was organized to achieve.



ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

130 PARK AVENUE, NEW YORK 17, N. Y. — 445 NORTH SACRAMENTO BOULEVARD, CHICAGO 12, ILL.
Goal: — achieve uniform specifications — uniform inspection — uniform products

pord continues as district sales manager of the central region, with headquarters at Cleveland, Ohio; *A. P. Lyvers*, assistant district sales manager at Chicago, becomes district sales manager, with the headquarters at Chicago; *Stanley See*, recently released from the armed forces and formerly in the sales department at Bay City, becomes district sales manager at Philadelphia, Pa.

ALLEGHENY LUDLUM STEEL CORPORATION.—Consolidation of the sales development and engineering service divisions of the Allegheny Ludlum Steel Corporation under the managership of *W. B. Pierce*, formerly manager of the sales development division, has been announced. The functions of the new department will be to coordinate and extend the company's cooperation with users and fabricators of stainless steel on their problems of applications and uses. Special attention will be given to the development of new markets for the introduction of new alloys.

OAKITE PRODUCTS, INC.—*J. C. Leonard*, formerly manager of the Chicago division of Oakite Products, Inc., has been appointed sales manager of the company's industrial marketing division, with headquarters in New York.

UNITED STATES STEEL SUPPLY COMPANY.—*Marcus J. Arelus* has been elected sales vice-president of the United States Steel Supply Company, a subsidiary of the United States Steel Corporation. His headquarters are at Chicago.

TENNESSEE COAL, IRON & RAILROAD CO.—A two-year expansion program at the Fairfield sheet mill of the Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., a United States Steel subsidiary, has begun, which will result in the conversion of the mill from the hot-rolled process of producing sheets to the cold-rolled method. Equipment for the production of galvanized sheet metal in coils will also be added to the mill.

H. K. PORTER COMPANY.—The H. K. Porter Company has announced the acquisition of the Brake Equipment & Supply Co. of Chicago, manufacturers of brake parts for railway locomotives and freight cars, and air brakes for export. Sales of the new acquisition will be handled by the Porter railway sales division.

GREAT LAKES STEEL CORPORATION.—*D. E. McGuire*, formerly assistant to the general works manager, has been appointed chief engineer of the Great Lakes Steel Corporation.

HANLON & WILSON CO.—*Walton R. Collins*, president of the Walton R. Collins Company, has been appointed railroad representative for Hanlon & Wilson Co., Pittsburgh, Pa., for a number of eastern railroads.

NEW YORK BELTING & PACKING COMPANY.—*George G. Deverall* has been appointed sales representative of New York Belting & Packing Company in New Eng-

land, New York, New Jersey, and Eastern Pennsylvania. His headquarters will be at the company's plant in Passaic, N. J., where he had been employed for 15 years previous to military service. *Walter E. Belcher*, manager of the Dallas district at 3439 Westminster street, Dallas, Tex., has retired. Mr. Belcher has been succeeded by his former assistant, *J. E. Conaway*.

HUNT-SPILLER MANUFACTURING CORPORATION.—*Frank W. Lampton*, formerly sales manager, has been appointed general sales manager of the Hunt-Spiller Manufacturing Corporation, Boston, Mass.

Frank W. Lampton was born in Fort Scott, Kan., in 1889 and is a graduate of Windsor Business College, Fort Scott. He began his career in 1907 as a machinist apprentice with the St. Louis-San Francisco at Fort Scott and served as a machinist from 1912 to 1915. He joined the Arcadia (Kan.) Coal & Mining Co., in 1915, as



Frank W. Lampton

master mechanic and in 1917 again became associated with the St. Louis-San Francisco. He served successively as night enginehouse foreman at Pittsburg, Kan.; general foreman, Wichita, Kan.; general foreman, Thayer, Mo., and general foreman, south shops, Springfield, Mo. Mr. Lampton joined Hunt-Spiller in 1926 as representative in the southwest territory. He was appointed assistant sales manager in 1941 and sales manager in 1942.

GRAYBAR ELECTRIC COMPANY.—*John P. Lawton* has been appointed northwestern district manager of the Graybar Electric Company. Mr. Lawton will have his office at northwestern district headquarters in Seattle, Wash., where he has served as district sales manager since December, 1944.

BAKER-RAULANG COMPANY.—*Douglas L. Darnell*, former sales manager, has been elected vice-president in charge of sales of the Baker-Raulang Company, Cleveland, Ohio. Mr. Darnell joined the firm's sales staff after World War I and was appointed sales manager in 1936.

AUTOMATIC TRANSPORTATION COMPANY.—*Jack A. McConnell*, former employment and personnel manager for the Delco products division of the General Motors Cor-

poration, has been appointed sales representative in the Columbus, Ohio, territory for the Automatic Transportation Company, 149 West Eighty-seventh street, Chicago, 20, manufacturers of electric propelled material-handling equipment.

OKONITE COMPANY.—*R. S. Keefer* has been appointed sales manager of the Okonite Company, Passaic, N. J. He succeeds the late Edward J. Garrigan, vice-president in charge of sales. Mr. Keefer, formerly assistant sales manager of the company's Hazard insulated wire works division, started his career in the Hazard insulating mill at Wilkes-Barre, Pa., in 1922, later entering the sales department in which he has been active for the past 20 years.

PARKER APPLIANCE COMPANY.—*J. E. Murphy* has been appointed manager of distributor sales and *D. A. Cameron* assistant general sales manager of the Parker Appliance Company, 17325 Euclid avenue, Cleveland, Ohio.

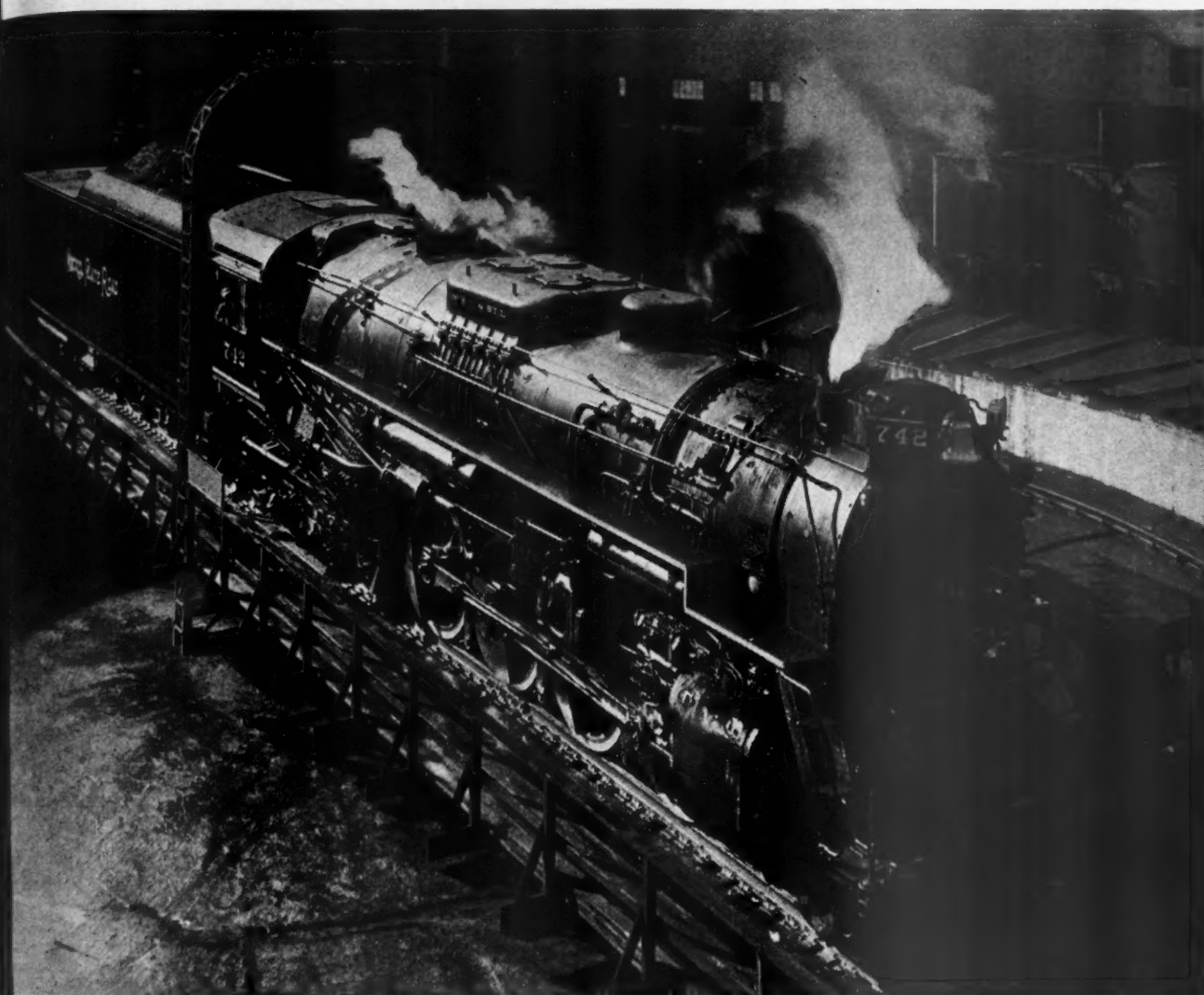
LAKE ERIE ENGINEERING CORPORATION.—The Lake Erie Engineering Corporation, Buffalo, N. Y., designers and manufacturers of hydraulic presses and special machinery, has taken over the Feller Engineering Company of Pittsburgh, Pa., specialists in hydraulic extrusion presses and allied lines. The activities of the former Pittsburgh company will be carried on by Lake Erie as its Feller engineering division. *K. Feller* will be general manager, with headquarters in the Empire Building, Pittsburgh.

S. KARPEN & BROTHERS.—*Ed Collins*, Railway Exchange Building, Chicago, and *Jack Armstrong*, Russ Building, San Francisco, Calif., it was announced, are representatives to certain key railroads for S. Karpen & Brothers and the *George B. Cross Company*, manufacturers and distributors respectively, of Karpen transportation seating.

KENNAMETAL, INC.—Kennametal, Inc., Latrobe, Pa., has opened a new Baltimore, Md., office for the selling and servicing of Kennametal tools, with *Alfred A. Anderson* in charge. The *H & H Tool & Supply Co.*, 211 North Broadway, Wichita, Kan., has been appointed a Kennametal agent in the Wichita area. The former Detroit, Mich., and Cleveland, Ohio, sales districts of Kennametal have been consolidated into a new central district. *Bennett Burgoon*, district manager of the Detroit area, has been appointed district manager of the new Central district, supervising activities of the Toledo, Ohio, and Cleveland branch offices, from his headquarters in Detroit. *Thomas O'Connell* has been appointed agent for the South Atlantic district, with headquarters in Asheville, N. C.

KOPPERS COMPANY.—*E. J. McGehee* has been appointed sales manager of Koppers Company, Inc. Mr. McGehee, also a vice-president of the company, in his new capacity will coordinate Koppers sales activities on a company-wide basis and will retain his Pittsburgh, Pa., headquarters.

E. J. McGehee first became associated



HEAVY PAYLOADS

...at passenger speeds

The Nickel Plate's fleet of fifty-five Lima-built 2-8-4s enables them to maintain the necessarily fast schedules required by today's freight demands. During the past five years, this railroad has been building up its motive power to enable it to handle maximum payloads at a maximum of efficiency and economy.

Freight train schedules are rapidly approaching the speeds of passenger schedules. Keep abreast of the times with power that is capable of meeting today's ever increasing demands.

LIMA LOCOMOTIVE WORKS



INCORPORATED, LIMA, OHIO

with the Koppers organization in 1934 and since that time has served in various executive positions in connection with the company's production and sale of pressure-treated timber for railway and utility work. He was appointed a vice-president in 1941. Before joining Koppers, Mr. McGehee was a production and sales executive of the Ayer & Lord Tie Company, which subsequently was purchased and merged with the Koppers Company. He is a past president of the Railway Tie Association and a member of the Western Railway Club, the New York Railway Club, the Pittsburgh Rail-



E. J. McGehee

way Club, and the American Wood Preservers Association. He is chairman of the Wood Industry Advisory Committee of the Office of Price Administration and secretary and treasurer of the Eastern Railroad Cross Tie Advisory Committee.

Obituary

ERNEST DUCHESNE, mechanical superintendent of all plants of the American Locomotive Company and its subsidiaries, died on August 25 at his home in Schenectady, N. Y. Mr. Duchesne was 67 years old. He was born in Napierville, Que., and joined the Montreal Locomotive Works, an American Locomotive subsidiary, in 1904. He was transferred to Schenectady in 1920 as general small-tool supervisor, and seven years ago was appointed mechanical superintendent.

ROBERT E. FRAME, president of Standard Car Sales, Inc., and vice-president of the Standard Car Truck Company, Chicago, died at his home in that city on August 7. Mr. Frame was born at Chicago on August 28, 1877, and received his education in the public schools there. He enlisted in the United States Army during the Spanish war, and in 1900 entered the employ of the Pullman Company. He resigned as freight-car estimator in September, 1904, to go with the American Car and Foundry Company as freight-car estimator at St. Louis, Mo. By 1909 he had progressed to the position of mechanical superintendent, with supervision over the drafting and estimating departments, and then became sales engineer at Chicago. In 1912 Mr. Frame resigned to become assistant to the president of the Haskell and Barker Car Company, Michigan City,

Ind. In September, 1923, he resigned from the Pullman Car & Manufacturing Co., (successors to Haskell and Barker) to be-



Robert E. Frame

come one of the founders of the Central Brake Shoe & Foundry Co. Six years later this firm was absorbed by the American Brake Shoe & Foundry Co., and Mr. Frame became associated with the Standard Car Truck Company. In 1939 he founded Standard Car Sales, Inc., of which he later became president, and in 1941 was elected vice-president of Standard Car Truck.

GROVER F. ILGEN, 58, vice-president and general sales manager of Airetool Manufacturing Co., Springfield, Ohio, died on Aug. 27 in University hospital, Columbus, Ohio. Mr. Ilgen had been associated with Airetool since its inception in 1930 by W. T. Hamilton, president of the company. Mr. Ilgen's association with Mr. Hamilton began when the latter was connected with the Press-Republic, a newspaper in Springfield,



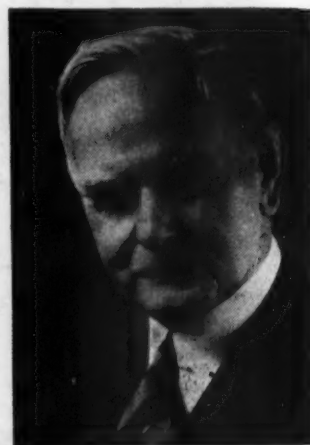
G. F. Ilgen

in the early 1900's. He followed Mr. Hamilton to the Lagonda Co., as a draftsman. When the company was sold to the Elliott Co., in 1918, Mr. Ilgen started a business venture of his own. He rejoined Mr. Hamilton when the latter organized Airetool, serving both as engineer and salesman.

CHARLES H. MCCREA, president and a director of the National Malleable & Steel Castings Co. since September, 1942, died

in Cleveland, Ohio, on August 24. Mr. McCrea was 56 years old. Mr. McCrea was born in Logansport, Ind., and was a graduate of Purdue University in 1912. He joined National Malleable in Toledo, Ohio, in 1913, as a special engineer. He advanced through many positions and served in various plants and sales offices, including sales work in foreign countries. He was a director of the Interlake Iron Corporation and of the Railway Business Association.

WILLIAM MARTIN WAMPLER, president of the Elcon Company and the National Brake Company, Inc., and eastern sales manager of the Morton Manufacturing Company, died in St. Elizabeth's Hospital, New York, on August 18. Mr. Wampler was 79 years old. He was born in Putneyville, Pa., and began work in the operation and maintenance departments of various street railways in 1891, serving successively with the Federal Street & Pleasant Valley Railway Company, the Duquesne Traction Company of Pittsburgh, Pa., the Union Company of New York and the Atlantic Avenue Railroad



W. M. Wampler

Company of Brooklyn. From 1894 to 1898 he was assistant superintendent and superintendent of rolling stock for the People's Traction Company and the Union Traction Company of Philadelphia. In 1899, Mr. Wampler joined the Allentown & Lehigh Valley Traction Co. of Allentown, Pa. He entered the railway supply business in 1900 as a salesman of cars and trucks for the Peckham Motor Truck & Wheel Co., Kingston, N. Y., and in 1901 joined Sturat-Howland of Boston, Mass., as New York sales representative. He returned to Peckham Motor in 1902 as vice-president in charge of sales, which position he held until 1906 when he was appointed sales manager, truck department, American Locomotive Company. With American Locomotive until the organization of the Elcon Company in 1910, Mr. Wampler was elected vice-president of National Brake in 1928 and president in 1940. He was a member of the Railroad Machinery Club of New York, the New York Railroad Club, the New England Railroad Club, the New York Electrical Society and the Engineers' Club of New York.

Make the most of...

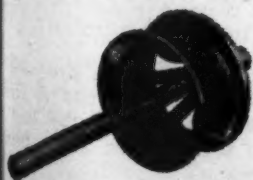
Locomotive modernization programs

● It is especially important, in connection with locomotive modernization programs, to weigh carefully the possibilities of the Franklin System of Steam Distribution.

There are no other changes or combinations of changes which you can make in existing motive power that will produce such fundamental improvements in locomotive performance. Without increasing fuel consumption or boiler capacity, you can increase horsepower at normal operating speeds by 20% to 40%. When this greater power is not being utilized, you will achieve fuel savings ranging from 20% to 40%.

With the Franklin System of Steam Distribution, piston valves are replaced with fast-acting, lightweight poppet valves. This permits the use of larger steam passages. Separate control of intake and exhaust valve events permits late release and suitable compression even at shortest cutoffs. Efficiency of transforming steam into horsepower hours is materially improved.

We would like to show you how this can be accomplished — practically — with your locomotives, either freight or passenger.



FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO • MONTREAL

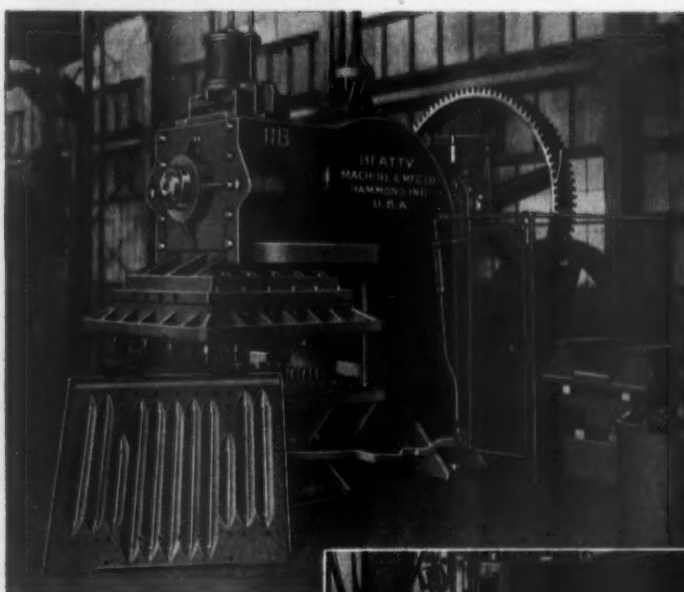
STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

Exceptionally large die space adapts machine to a wide variety of set-ups



LEADING RAILROAD SHOPS AND CAR BUILDERS USE

BEATTY machines



BEATTY NO. 11-B
MULTIPLE PUNCH AND
SPACING TABLE



A BEATTY heavy duty punch, equipped with special tools, can handle the most complicated punching and slotting requirements in one pass through. It is an important unit in the complete line of BEATTY-ENGINEERED punches, presses, shears, bull-dozer and spacing tables extensively used in your industry. When you have a heavy metal working problem to solve let us give you the benefit of our long and intimate experience in your field.



**BEATTY MACHINE AND
MFG. COMPANY**
HAMMOND, INDIANA

587 (Adv. Pg. 94)

Personal Mention

General

L. W. DOWNEY, superintendent of motive equipment of the Chicago, Rock Island & Pacific at Chicago, has retired.

M. C. SHARP, Diesel supervisor of Chicago, Rock Island & Pacific at Memphis, Tenn., has been appointed superintendent of automotive equipment, with headquarters in Chicago.

GEORGE W. COVERT, assistant general superintendent of the Montour, has been appointed general superintendent with supervision over operating and mechanical departments and headquarters at Coraopolis, Pa.

E. C. MEINHOLTZ has been appointed engineer of tests of the Missouri Pacific, with headquarters at St. Louis, Mo.

JAMES NAGEL, general superintendent with supervision over operating and mechanical departments of the Montour, Coraopolis, Pa., has retired because of ill health.

Diesel

L. W. VAN NATTAN has been appointed supervisor of Diesel equipment of the Kansas City Southern, with headquarters at Pittsburg, Kan.

Master Mechanics and Road Foremen

H. A. MCFAYDEN, master mechanic of the Canadian National, at Edmonton, Alta., has been transferred to Calgary, Alta.

L. H. COOPER has been appointed master mechanic of the Atlantic Coast Line, with headquarters in Jacksonville, Fla.

Electrical

F. A. ROGERS, electrical supervisor of the New York, New Haven & Hartford, has been appointed engineer, electric lighting and distribution, with headquarters before at New Haven, Conn.

Car Department

C. E. MILLER has been appointed superintendent, air-brake equipment and steam heat, of the New York Central at New York.

H. SUNDIN, division air-brake inspector of the New York Central at Avis, Pa., has had his title changed to supervisor of air brakes and steam heat.

W. R. MCHENRY, division air-brake inspector of the New York Central at Grand Central Terminal, New York, has had his title changed to supervisor of air brakes and steam heat.

E. F. COOPER, division air-brake inspector of the New York Central at Albany, N. Y., has had his title changed to supervisor of air brakes and steam heat.

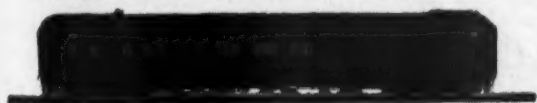
J. H. RUSSELL has been appointed assistant superintendent, air-brake equipment and steam heat, of the New York, New Haven & Hartford.

Railway Mechanical Engineering
OCTOBER 1934



Our Interest Does Not End With The Delivery of Your Diesels

YOUR General Motors Diesel locomotives are built to run at peak performance at all times. But, being mechanical, they must be efficiently maintained and operated to assure that high degree of performance.



Our Instruction Car is a familiar sight on customer-railroads the country over. It has given instruction to all classes of railroad personnel. Lower operating costs and higher efficiency have been the result.

The Electro-Motive Diesel Locomotive School at La Grange serves much the same purpose in training the supervisory maintenance and operating personnel of customer-railroads.

Spacious, well-equipped classrooms are provided. Modern teaching aids make the course interesting as well as instructive. Motion pictures, slide films, charts and cut-away equipment are used extensively. Near by in the plant, locomotives in all states of construction are available for observation.

With the additional instructors and classroom facilities now available in the new Service Building, the school is in a better position than ever to serve our railroad customers.

For full details, including a quick day-by-day look at the course, a brief, illustrated booklet is available to any railroad man serving in executive or supervisory capacity. Write to D. H. Queeney, Service Manager, Electro-Motive Division, General Motors, La Grange, Illinois.

This is only one of the plus values that goes with the purchase of General Motors Diesel locomotives.

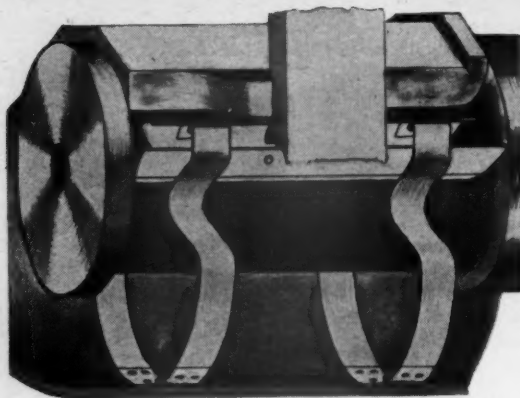


ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
LA GRANGE, ILLINOIS

Avoid HOT BOXES

by applying

ROBOT



Journal Box Packing Retainers

ROBOT Packing Retainers maintain constant contact with the journal on the roughest track and through switching jolts. Avoids hot boxes and cut journals by—

- • • keeping the packing in position in box and away from brass at all times preventing loose strands of waste, lint or grit from reaching the bearing.
- • • providing a clean, even film of oil along the full length of journal.

40 railroads and private car lines have already made installations on high speed passenger cars, freight equipment and locomotive tenders.

Prepare for difficult operating conditions in the winter weather ahead by applying ROBOT Retainers now!

CHICAGO FREIGHT CAR & PARTS CO.
228 N. LA SALLE STREET, CHICAGO 1, ILL.
SHOP AND YARDS: CHICAGO, ILL. • PUEBLO, COLO.

No Layout needed!



**.. for punching,
slotting and
notching of
plates**

**One-man Operation; Positive Control;
Quick, Accurate Positioning**

Where runs are too short to justify the use of a spacing table, or where irregular plates must be handled, this modern Thomas Duplicator is ideally adapted. It affords rapid, precision duplication of

holes, notches or slots, and will speed production in car-shops, bus and truck building plants and in numerous other fabricating operations in varied industries.

Write for Bulletin 312

THOMAS
MACHINE MANUFACTURING COMPANY

PITTSBURGH 25, PA.

Haven & Hartford, with headquarters at New York.

G. B. GIPSON has been appointed assistant general car foreman of the Illinois Central at Centralia, Ill.

L. H. ALBERS, supervisor of air brakes, of the New York, New Haven & Hartford at Albany, N. Y., retired on July 31.

Shop and Enginehouse

W. G. CARLSON, general foreman, motive-power department, of the Erie at Dayton, Ohio, has been appointed general foreman, motive-power department, at Buffalo, N. Y.

J. G. HOLDREN has been appointed lubrication inspector of the Atlantic Coast Line with headquarters in Wilmington, N. C.

FRANK D. SINEATH has been appointed general foreman at the Jacksonville, Fla. shops of the Atlantic Coast Line.

W. F. BLATCHFORD, assistant locomotive foreman of the Canadian National at Kamloops, B. C., has been appointed district boiler inspector, with headquarters at Winnipeg, Man.

JOHN GENTLES, locomotive foreman of the Canadian Pacific at Bredenbury, Sask., has been promoted to the position of locomotive foreman at Field, B. C.

DAVID FRANCIS, locomotive foreman of the Canadian Pacific at Field, B. C., has been transferred to the position of locomotive foreman at Winnipeg, Man.

Obituary

GEORGE T. JOHNSON, who retired on February 1 as assistant electrical engineer of the New York, New Haven and Hartford, died of a heart ailment at his summer home at Hyannis, Mass., on August 26, at the age of 70. A biography of Mr. Johnson appeared in the March issue in connection with his retirement.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

CARBURIZER-NITRIDER.—Hevi Duty Electric Company, Milwaukee, Wis. A 28-page illustrated bulletin, HD646, describes the construction and operation of this equipment in carburizing and nitriding small steel parts subject to wear also gives specifications and pit layouts.

AIR REDUCTION BOOKLETS.—Air Reduction Sales Company, 60 East Forty-Second street, New York 17. "Oxyacetylene Flame Processes and Arc Welding in Railroad Mechanical Operations," a 48-page illustrated book, describes approved methods of doing many shop maintenance and fabrication jobs. "Safety Precautions Rules," a 24-page, pocket-size manual published by the Railroad Section, Technical Sales Division of Air Reduction, covers the "do's and don'ts" of air reduction.



TAKE OUT
SLACK ACTION

... and You put in *Profits*

Slack Action!—saboteur of rolling equipment and enemy of passenger comfort—"HSC" Electro-Pneumatic Brake can help you defeat it.


"HSC" Electro-Pneumatic Brakes embody electric control for simultaneous, uniform application and release of brake force on every car in the train. Each brake does its equally proportional share of retarding—all working in harmony to stop trains smoothly and quickly. Definite by-product of this simultaneous and uniform brake action, is the disappearance of slack action. And, when slack action vanishes, passenger comfort mounts and maintenance costs go down. Both are factors in profitable railroading.

Specify this Westinghouse trio for Passenger Service:

"HSC" Electro-Pneumatic Brakes . . . for braking flexibility to match modern train speeds, and unequalled smooth action

Speed Governor Control . . . for regulating brake forces to wheel speeds

"AP" Decelostat . . . for wheel slip detection to keep the wheels rolling



Brakes are Basic
to
Railroad Progress

⌘ Westinghouse Air Brake Co.

WILMERDING, PA.

**Here
is the
Answer!**

**TO YOUR PROBLEM
OF GAUGING
WATER TENDER TANKS**



The Midget Levelometer is a dial type hydrostatic tank gauge that responds to slight changes in the amount of water being measured, yet it is rugged in construction and especially built to withstand the vibration and shock to which all railroad equipment is subjected.

OUTSTANDING FEATURES:

1. **Dial type, easy to read.**
2. **Automatic indication when connected to a source of continuous air supply.**
3. **Simple to install.**
4. **A suitable length of $\frac{1}{2}$ " pipe is all that is required within the tender tank.**
5. **Designed and built by the country's largest manufacturer of Liquid Level Gauges.**

The I.C.C. has ordered all water tender tanks to be equipped with water level indicators not later than June, 1948. Here is an inexpensive and efficient way to meet the Commission's requirements by equipping your tenders with Midget Levelometers . . . We can also furnish liquid level gauges for any of your stationary storage tanks.

Write, wire or phone for a quotation and delivery date.

THE LIQUIDOMETER CORP.
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Stillwell 4-1440

don'ts" for handling oxyacetylene and arc equipment. Shows clearly the care to be exercised when using gas cylinders, torches and regulators, hose lines, and generators. Sections devoted to prevention of backfires and flashbacks, welding of tanks, safe practices in the use of arc-welding equipment, etc., with notes on personal safety.

SELENIUM RECTIFIER EQUIPMENTS.—Federal Telephone and Radio Corporation, Newark 1, N. J. Twelve-page illustrated booklet showing equipments, powered by Selenium Rectifiers, for d.c. requirements, together with specifications and ratings. Among the equipment pictured are industrial power supplies, general purpose battery chargers, industrial truck and central station, battery chargers, electroplating requirements, cathodic protection equipments, telephone battery chargers, and round, rectangular and square rectifier plates.

PRODUCTION DRILLING.—Republic Drill and Tool Company, 322 South Green street, Chicago 7. Bulletin J-2 describes "Hyper-Drilling" with the new Republic "Jet" drill and "Jet" director, Hyper-Drilling being described as a new technique for drilling holes in metal.

PITTSBURGH FORGINGS AND GREENVILLE STEEL CAR PRODUCTS.—Pittsburgh Forgings Company, Coraopolis, Pa. "A Pictorial Record of Pittsburgh Forgings Company and the Greenville Steel Car Company," a 64-page booklet printed in color. Illustrates typical products of the forge plants as produced for war and peace and reviews some of the outstanding war- and peacetime manufacturing facilities of the Greenville Steel Car Company.

ROD SELECTOR CHART.—Eutectic Welding Alloys Corporation, 40 Worth street, New York 13. An 18-in. by 23-in. Rod selector chart lists Eutectic products and their suggested applications; gives bonding and remelting temperature for each alloy, as well as the Brinell hardness, and the strength in pounds per square inch of Eutectic "low temperature" welding alloys.

WIRE-ROPE CLIPS.—American Hoist & Derrick Company, St. Paul 1, Minn. Information card shows the correct method of fastening Crosby clips and gives application data.

GRINDING MACHINERY AND GRINDING WHEELS.—The Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn. Sixteen-page Catalogue No. 146, printed in color, contains sections on horizontal face grinders, vertical surface grinders, knife grinders, floor-stand grinders, buffing lathes, cutlery grinders, cut-off machines, special grinding machines, and grinding wheels.

WHITING DROP TABLES.—Whiting Corporation, Harvey, Ill. Bulletin DTC-403, a 36-page catalogue printed in two colors, illustrates and describes the construction, operation, special arrangements, accessories, and modified designs of Whiting drop tables for Diesel, electric, and steam locomotives. Gives also practical suggestions for pit construction and track layout.

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